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Russia: Calculation of Aerodynamic Characteristics of Ellipsoidal Forebodies at Hypersonic Speeds

964D0845A Moscow UCHENYE ZAPISKI TSAGI
in Russian Vol 24 No 4, 1993 pp 3-12

[Article by V. A. Bashkin and I. V. Yegorov; manuscript received 26 Feb 92; UDC 533.6.011.55.011.6 532.526.011.55.011.6]

[FBIS Summary] Based on the full Navier-Stokes equation with isolation of the bow shock wave, the authors study supersonic air flow past axisymmetric forebodies in the shape of ellipsoids of revolution that have coefficient of ellipticity δ ranging from 1.0 to 10.0. The surface in the flow was taken as absolutely non-heat-conducting, and thermal energy was assumed to come from it in accordance with Stefan-Boltzmann law. Perfect and imperfect gases were used as the model of moving media; in the latter case, nonequilibrium thermochemical processes occur in the moving medium. An examination is made of local characteristics on the surface of the body as a function of Reynolds number, coefficient of ellipticity and catalytic properties of the surface. The results of the study show that the proposed numerical method enables determination of aerodynamic characteristics of blunt axisymmetric forebodies under conditions of hypersonic flight with engineering accuracy. Further research is needed to improve the effectiveness of the numerical algorithm, especially with regard to determining the distribution of local friction stress for very slender bodies, which presents difficulties because of the occurrence of oscillations in the vicinity of the maximum. Figures 7, references 8.

Russia: Maximum Lift-Drag Ratio of Bodies in Flow with Plane Shock

964D0845B Moscow UCHENYE ZAPISKI TSAGI
in Russian Vol 24 No 4, 1993 pp 13-23

[Article by V. V. Keldysh; manuscript received 22 Jun 92; UDC 629.782.016.7:533.6.013.12/.13]

[FBIS Summary] The author looks at the problem of selecting the shape of a hypersonic waverider with trapezoidal leading edge that has maximum lift-drag ratio for ideal conditions (assigned Mach and Reynolds numbers) in a flow with plane shock for given volume ratio and lift coefficient. It is shown that in the case of an entirely laminar or entirely turbulent boundary layer on the surface of the body for the prescribed geometric conditions and lift coefficient, the optimum shape does not depend on the Reynolds number, which affects only the state of the boundary layer, and accordingly the lift-drag ratio of the body. A parametric study is done on the effect that the prescribed conditions have on the optimum shape of the waverider and its lift-drag

ratio under ideal flow conditions. Figures 7, formulas 8, references 10.

Russia: Flow Around Flat Bodies with Two Sharp Trailing Edges When a Jet Discharges Between Them

964D0845C Moscow UCHENYE ZAPISKI TSAGI
in Russian Vol 24 No 4, 1993 pp 24-33

[Article by V. M. Shurygin; manuscript received 16 Mar 92; UDC 629.735.33.015.3:533.695.7]

[FBIS Summary] In the case of flow past an airfoil with sharp trailing edge, the Chaplygin-Zhukovskiy condition of flow leaving the trailing edge determines a unique solution of the problem. But in the case of a flat missile with an engine, or a flat engine with intake and nozzle, there are two sharp trailing edges lying on the edge of the nozzle. When studying smooth flow of an ideal fluid past bodies of this kind, it is generally assumed both sharp trailing edges are points of runoff. Based on his own theory (see "Aerodinamika tel so struyami" [Aerodynamics of Bodies with Jets], Moscow Mashinostroyeniye, 1977), the author studies such flows and shows that they are special cases that are generally of no practical interest. In the general case, a fluid in steady-state flow picks one of the sharp trailing edges as a point of runoff. If this cannot be realized, flow around the body will be unsteady with runoff of vortex trails from two sharp trailing edges. The author considers flat bodies in an infinite jet flow of ideal incompressible fluid with constant density throughout the flow at Beaufort force of zero. Figures 12, formulas 8, references 6.

Russia: Backflow Model for Reattaching Mixing Layer

964D0845D Moscow UCHENYE ZAPISKI TSAGI
in Russian Vol 24 No 4, 1993 pp 34-40

[Article by A. V. Pilyugin; manuscript received 25 May 92; UDC 532.526.5]

[FBIS Summary] A one-parameter power-law model is constructed for the mean velocity profile in the backflow zone of a reattaching mixing layer that accounts in the boundary-layer approximation for the balance of inertial forces and viscous stresses. It is shown that with appropriate choice of the exponential parameter, the model profile of mean velocity in the backflow zone agrees nicely with experimental data (D. W. Etheridge, P. H. Kemp, "Measurement of Turbulent Flow Downstream of a Rearward-Facing Step," Journal of Fluid Mechanics, Vol 86, Part 3, 1978). Comparison of the proposed model with Simpson's one-parameter logarithmic model (R. L. Simpson, "A Model for the

Backflow Mean Velocity Profile," American Institute of Aeronautics and Astronautics Journal, Vol 21, No 1, 1983) shows that Simpson's model does not reflect the actual balance of viscous and inertial forces in the reattachment zone, and therefore its application is limited to the initial section of the detachment zone. Figures 4, formulas 10, references 3.

Russia: Aerodynamic Characteristics of Forebodies of Solids of Revolution with Ryabushinskiy Generatrix in the Transonic Velocity Range

964D0845E Moscow UCHENYE ZAPISKI TSAGI in Russian Vol 24 No 4, 1993 pp 41-44

[Article by V. V. Vyshinskiy and Ye. N. Kuznetsov; manuscript received 22 Jun 92; UDC 533.6.011.35:532.582.33]

[FBIS Summary] The paper gives the results of experimental studies of the aerodynamic characteristics of forebodies of solids of revolution in the transonic range of incident flow velocities. It is shown that flat-blunted forebodies with Ryabushinskiy generatrix have optimum aerodynamic characteristics at Mach numbers of the incident flow $M_\infty < M_{*0} < 0.97$ and angles of attack $0 < \alpha < 10^\circ$. The authors thank Yu. A. Arutyunov, who was the impetus for this work, for his useful discussion of the results, and V. A. Yakovleva for doing the balance experiment. Figures 5, references 3.

Russia: Some Features of Using Laser Knife Method in Supersonic Wind Tunnels

964D0845F Moscow UCHENYE ZAPISKI TSAGI in Russian Vol 24 No 4, 1993 pp 45-54

[Article by A. I. Maksimov; manuscript received 7 Apr 92; UDC 533.6.071.082.5:621.375.8]

[FBIS Summary] Based on generalization of experience with use of the laser knife in wind tunnel T-313 of the Institute of Theoretical and Applied Mechanics, Siberian Department, Russian Academy of Sciences, the author determines the characteristic features of this method that have an appreciable effect on quality of the information obtained. A more precise value is found for the amount of injected water needed to produce light-scattering particles throughout the range of basic tunnel operating conditions. It is shown that frame lighting is strongly dependent on the relative location of the model and the camera in the working zone. Procedural tests are done at $M_\infty = 2-4$. By way of example, a typical sequence diagram is given of an experiment on visualizing flow by the laser knife technique in tunnel T-313. Under optimum working conditions, a high-quality laser knife image can be obtained in only 1.5-2 minutes, and tests can be continued practically uninterrupted.

The author thanks A. A. Zheltovodov, E. Kh. Shileyn, A. M. Shevchenko and A. A. Pavlov for taking part in individual stages of the research and for helpful comments in discussion of the results. Figures 6, tables 2, references 7.

Russia: Investigation of Specific Features of Kinematics of Detached Eddy Flows by LDV Method

964D0845G Moscow UCHENYE ZAPISKI TSAGI in Russian Vol 24 No 4, 1993 pp 55-63

[Article by I. Yu. Burdin and V. A. Pesetskiy; manuscript received 3 Mar 92; UDC 533.6.071.082.5:621.375.8 629.735.33.015.3.025.1:532.526]

[FBIS Summary] The paper gives the results of experimental LDV and oil film studies of flow past low-aspect wings and canards equipped with low-aspect wings. Measurements are made of the flow velocity distribution in cross sections perpendicular to the mid surface at angles of attack of 15 and 25°, and a Reynolds number of $Re = 1.5 \times 10^6$. It is shown that the velocity field in the whirl core formed on the control canard is analogous to that in the wake, while the field in the whirl core set up on the aft wing is like that of the jet. These vortices exist separately up to angles of attack of 25° without forming a merged eddy system above the wing and in the near wake. The authors thank N. P. Ilyashenko and Ye. K. Chumachenko for assisting in the work. Figures 7, references 12.

Russia: Study of Wind Tunnel Starting and Stalling Characteristics with Tangential Injection into the Diffuser Section

964D0845H Moscow UCHENYE ZAPISKI TSAGI in Russian Vol 24 No 4, 1993 pp 64-81

[Article by N. A. Shushin; manuscript received 4 Nov 91; UDC 533.6.071.4 532.556.4]

[FBIS Summary] The author studies the effect that tangential injection into the diffuser section has on the starting and stalling pressure ratios of a wind tunnel at Mach number $M = 5$. A considerable reduction of pressure ratio is attained. An investigation is made of the effect of length of the working section, length of the diffuser section, and dimensions of the injection nozzle. The author gives the method used for calculating injection parameters. Calculated results agree with experiment. It is concluded that a diffuser with injection can be successfully used on high-Mach wind tunnels on airplane and rocket engine test stands. Tangential injection can be used in ejector diffusers. Figures 7, formulas 20, references 19.

Russia: Aerodynamics of Ducted Wind Wheel with Outlet

964D08451 Moscow UCHENYE ZAPISKI TSAGI
in Russian Vol 24 No 4, 1993 pp 82-95

[Article by L. Ya. Khaskin; manuscript received 2 Apr 92; UDC 621.54]

[FBIS Summary] The author looks at some aerodynamic designs of wind motors in the form of a ducted wind wheel with different kinds of outlets. The resultant aerodynamic characteristics (coefficient of utilization of wind energy, flow rate and hydraulic drag) are compared with those of an isolated wind wheel. Some experimental results are given, and working conditions of a wind motor are determined that are optimum from the standpoint of aerodynamics. It is found that ducted wheels provided with outlets start at roughly half the wind speed of those without them. Thus, such units might be advantageous in areas with light breezes where isolated wind wheels do not work. The use of an outlet also eliminates losses due to swirling of the flow behind the wheel and detachment of flow at the trailing edge of the vane. Disadvantages of ducted wheels with outlets are greater specific consumption of materials, and a 20% increase in aerodynamic loads acting on the outlet unit. Figures 6, tables 3, formulas 17, references 6.

Russia: Action on Jets by Longitudinal Vortices

964D0845J Moscow UCHENYE ZAPISKI TSAGI
in Russian Vol 24 No 4, 1993 pp 96-106

[Article by G. A. Ganich, N. A. Gushchina, Yu. G. Zhulev and A. G. Nalivayko; manuscript received 12 Nov 92; UDC 532.525.2]

[FBIS Summary] The paper gives the results of experimental studies of the use of longitudinal vortices to control the cutting action of submerged jets discharged from axisymmetric nozzles. The vortices were produced by notching convergent nozzles, and by using slotted swirler attachments. It is shown that compact swirlers in the outlet section of nozzles can considerably increase the cutting action of free and near-wall jets discharged from circular and rectangular nozzles, as well as controlling the cross sectional shape of jets with minor losses of momentum. Figures 9, references 2.

Russia: Engineering Method of Designing Ejector with Allowance for Real Properties of Gas

964D0845K Moscow UCHENYE ZAPISKI TSAGI
in Russian Vol 24 No 4, 1993 pp 107-112

[Article by V. I. Allferov, Ye. G. Zaytsev and G. M. Ryabinkov; manuscript received 26 Dec 91; UDC 553.697.5]

[FBIS Summary] The authors consider an approximate method of calculating an optimum gas ejector with allowance for the real properties of miscible gases. Isentropic and adiabatic gas flow is considered in the absence of condensation at moderate temperatures ($T = 250-350$ K) and pressures ($p_0 = 4-20$ MPa), using the coefficient of compressibility z in the equation of state, and the effective adiabatic exponent $\kappa_e = \kappa_0$ in the gasdynamic equations, where i is enthalpy and u is internal energy. It is shown that the nonideal properties of a real gas reduce the geometric dimensions of the ejector. Figures 2, formulas 15, references 10.

Russia: Various Modes of Self-Induced Slender Delta Wing Rock Oscillations

964D0845L Moscow UCHENYE ZAPISKI TSAGI
in Russian Vol 24 No 4, 1993 pp 113-123

[Article by A. N. Zhuk, G. N. Sirolyarov (deceased) and A. N. Khrabrov; manuscript received 2 Oct 91; UDC 629.735.33.015.4.533.6.013.422.629.7.025.1]

[FBIS Summary] An experimental study is done on self-induced wing rock of a delta wing with sweepback angle of the leading edge $\chi_{LE} = 80^\circ$ in a wind tunnel at low subsonic velocities. It is found that the usual well studied quasiharmonic low-amplitude ($\theta = 10^\circ$) self-oscillations are transformed in a certain range of angles of attack to oscillations of a more complicated nature with two unstable centers. In addition to such harmonic and anharmonic self-oscillations of moderate amplitude, there is also a limiting cycle with oscillations of large amplitude $\theta = 30-40^\circ$ that is also observed in a wide range of angles of attack. Figures 6, formulas 3, references 11.

Russia: Analysis of Results of Modal Tests in Case of Closely Spaced Natural Frequencies

964D0845M Moscow UCHENYE ZAPISKI TSAGI
in Russian Vol 24 No 4, 1993 pp 124-127

[Article by B. V. Grigoryev; manuscript received 2 Aug 89; UDC 629.7.015.4.533.6.013.43]

[FBIS Summary] Previous research has shown that methods based on a mathematical model proposed by M. S. Galkin [see "Identification of Structural Damped

Vibrational Systems" in: "Proceedings of 14th Congress of the International Council of the Aeronautical Sciences," September 1984] can be used in processing data of modal tests with harmonic excitation. In this article, the author proposes a recursion algorithm for determining dynamic characteristics with numerical separation of an arbitrary number of closely spaced natural frequencies. Formulas 12, references 3.

Russia: Computational and Experimental Method of Accounting for the Effect that Model Overweight Has on Aircraft Flutter Characteristics

964D0845N Moscow UCHENYE ZAPISKI TSAGI in Russian Vol 24 No 4, 1993 pp 128-139

[Article by M. S. Galkin and L. P. Lushchin; manuscript received 16 Jan 92; UDC 629.7.015.4:533.6.013.422]

[FBIS Summary] A computational and experimental method is proposed for correcting the results of flutter tests of elastic overweight dynamically scaled models in wind tunnels at subsonic, transonic and supersonic speeds. Various methods are given for determining corrections for mass parameter dissimilarity in determining the critical velocity head of flutter for a model with overweight. A significant feature of the proposed method is that the results are comparatively weakly dependent on errors in assignment of initial data. Solution is simple. Figures 6, formulas 21, references 5.

Russia: Investigation of the Effect of Friction on the Stress-Strain State and Load Bearing Capacity of Three-Dimensional Joints Fabricated with the Use of Composites

964D0845O Moscow UCHENYE ZAPISKI TSAGI in Russian Vol 24 No 4, 1993 pp 140-147

[Article by T. K. Begeyev, V. I. Grishin, V. B. Litvinov and K. N. Malysheva; manuscript received 25 Feb 92; UDC 629.7.015.4.023.62-419.8 629.7.015.4.023.8.624.078.2]

[FBIS Summary] A finite element method of calculating the stress-strain state of three-dimensional joints is implemented in the FITTING applied software package. The structural components of the joint may be made both of metal and of laminated composite orthotropic materials. The accuracy of the proposed technique is substantiated, and examples are considered of the calculation of joints designed for transfer of concentrated forces. Figures 6, formulas 14, references 5.

Russia: Information Coding in Data Acquisition Systems in a Flight Experiment

964D0845P Moscow UCHENYE ZAPISKI TSAGI in Russian Vol 24 No 4, 1993 pp 148-151

[Article by O. V. Nakonechnyy; manuscript received 17 Apr 92; UDC 629.735.33.018.7.53.087]

[FBIS Summary] The author proposes a simple suboptimum code for compression of data acquired in a flight experiment. Even with the simplest coding algorithm, data compression by a factor of 2.5 is attained, and the code itself fits readily into the byte stream. Figure 1, table 1, references 13.

Russia: Controlling Propagation of Short Radio Waves by Using Intense Radio Emission to Modify the Ionosphere

964D0946A Nizhny Novgorod IZVESTIYA VUZOV: RADIOFIZIKA in Russian May 93 Vol 36 No 5, pp 390-397

[Article by L. M. Yerukhinov, V. A. Ivanov, V. D. Kostromin, V. S. Maksimov, N. A. Mityakov, S. V. Rozanov, N. V. Ryabova, V. P. Uryadov and V. V. Shumayev, Mari Polytechnic Institute; 17 Dec 91; UDC 550.388.2:621.371.25]

[FBIS Summary] The authors determine the conditions of capture of short waves into the ionospheric waveguide channel due to refraction by the gradient of electron concentration along the path of propagation, consider the possibility of using aspect scattering by artificial ionospheric inhomogeneities to control ionospheric waves ducting, study the influence that geomagnetic and ionospheric disturbances have on effectiveness of coupling energy out of the channel, and investigate the frequency-time characteristics of waveguide modes. The ionosphere was probed from Khabarovsk in the frequency band of 6-28.4 MHz. The rate of frequency variation was 350 kHz/s. An RG 654-1 antenna was used for transmission ($\lambda_0 = 19$ m), and signal power at the antenna input was 0.5 kW. Observations were made from 18 through 23 March 1991 from 22:00 to 06:00 Moscow time, when the negative gradient of electron concentration supporting capture of radio waves into the ionospheric waveguide channel was maximum on this path for the given season (equinox). It was found that the time interval of existence of the ionospheric waveguide channel controllable by intense short-wave radio emission lies in the range of poorest conditions for mode hopping propagation (22:00-03:00). Capture due to refraction by a horizontal negative electron concentration gradient occurs when $\text{grad } f_o$ becomes less than $(3.4) \times 10^2 \text{ MHz/100 km}$. It is shown that short

waves can be coupled out of the ionospheric waveguide channel when the level of geomagnetic activity is low ($K_p = 1-2$) and there are no negative ionospheric perturbations. Experiments show that the frequency band of the extracted waveguide mode of propagation is $\Delta f = 2-3$ MHz. The authors thank I. V. Ryabov, N. M. Bogutu, V. A. Zyuzin and A. V. Rakhlin for helping with the experiment. Figures 5, references 4.

Russia: Generation of Powerful Alfvén Waves as a Result of Development of Explosive Instability in Flow-Plasma System

964D0942A Nizhniy Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian Oct 95
Vol 38 No 10, pp 1060-1063

[Article by A. Ye. Belyantsev and S. M. Faynshteyn, Nizhgorodskiy Technical University; Manuscript received 10 Jan 95; UDC 533.951]

[FBIS Summary] The paper looks at the possibility of development and stabilization of an explosive instability of Alfvén and sound waves in a system that consists of a cold plasma penetrated by completely ionized stream of charged particles with allowance for finiteness of pressure in the beam. The case of a weak beam is considered, where modes are excited explosively rather than exponentially. Mode locking conditions are considered. It is shown that under certain conditions, powerful magnetic field pulses may be generated in such a system. The results may be of interest in astrophysics and controlled fusion. The work was done under ISF grant number 88000, and the results were reported in part to the EUROEM Conference (Bordeaux, 1994). Formulas 7, references 4.

Russia: Limits of Applicability of Method of Refraction Scattering of Radio Waves

964D0945A Nizhniy Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian Nov 95
Vol 38 No 11, pp 1118-1123

[Article by V. A. Alimov, Radiophysics Research Institute, Nizhniy Novgorod; manuscript received 9 Sep 94; UDC 621.371.25]

[FBIS Summary] The author compares the computational capabilities of the radio wave refraction scattering (RWRS) method and the parabolic equation method (PEM) in calculations of the statistical characteristics of radio waves in a medium with large-scale inhomogeneities. It is shown that the limits of applicability of the RWRS method as a whole are limited by the corresponding limits of applicability of PEM. However, unlike PEM, the RWRS method in some cases allows derivation of analytical expressions for the statistical

characteristics of radio waves when they are diffracted in a thick layer with large-scale inhomogeneities. Besides, some statistical characteristics are found by the RWRS method by using simpler computational procedures than for PEM. The work was done within the scope of RFRF project 95-02-03716. Figure 1, formulas 12, references 6.

Russia: Method of Determining Intensity of Extraterrestrial Radio Sources Against an Inhomogeneous Surrounding Background

964D0945B Nizhniy Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian
Vol 38, No 11 Nov 95 pp 1158-1167

[Article by N. A. Dugin, O. M. Kovalchuk and Ye. Yu. Shnyrova, Radiophysics Research Institute, Nizhniy Novgorod; manuscript received 10 Mar 94; UDC 520.27]

[FBIS Summary] A method is proposed for measuring the intensity of radio emission from a discrete source and for processing measurement results that minimizes the error of determining the magnitudes of radio contrasts by correctly accounting for the background radiation surrounding the source, as well as standardizing the measurement and data processing procedure. To account for the nonuniformity of distributed cosmic radiation, the antenna temperature is measured with sequential aiming at the source, and at a reference region. The directional pattern of the antenna is moved away from the source and aimed at reference regions only in azimuth by a minimum angular distance such that the source is at the first "zero" of the radiation pattern. Due to rotation of the earth, the antenna is aimed at a new reference region each time it moves away from the source. The paper gives the results of experimental verification of the proposed method on a frequency of 575 MHz using the four most powerful discrete radio sources. Figures 6, table 1, formulas 7, references 7.

Russia: Computer Model of Meteor Burst Radio Channel

964D0945C Nizhniy Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian Nov 95
Vol 38 No 11, pp 1177-1186

[Article by A. V. Karpov, Kazan State University; manuscript received 26 Apr 95; UDC 621.391.818.8]

[FBIS Summary] The paper offers a computer model of a meteor burst radio channel realized by a Monte Carlo method. It is shown that effective selection of model parameters is possible. Satisfactory agreement is attained between results of modeling and experimental data obtained on meteor burst radio lines 240, 700 and 1100

km long. The model is implemented in the KAMET software package on an IBM AT computer. Calculations can be done for meteor burst radio lines as long as 2200 km arbitrarily oriented for any month and hour of observations with interactive data input. The use of an experimental astronomical base enables exact prediction of seasonal and diurnal variations of the characteristics of meteor burst radio lines deployed in the northern hemisphere. The model also enables optimization of meteor burst radio communication performance. Figures 5, Table 1, formulas 17, references 15.

Russia: Synchronous Acceleration and Capture of Electron Beam in Anomalous Doppler Maser with Distributed Extraction of Radiation

964D0945D Nizhny Novgorod IZVESTIYA VUZOV: RADIOFIZIKA in Russian Nov 95
Vol 38 No 11, pp 1187-1194

[Article by V. A. Kubarev, Moscow State University; manuscript received 10 Jul 95; UDC 621.385.6]

[FBIS Summary] Efficiency of anomalous Doppler masers with homogeneous slow-wave structures and driving magnetic field is limited because the beam drops out of step with the wave due to simultaneous increase in relativistic cyclotron frequency and decrease in longitudinal velocity of electrons during emission. This can be rectified by distributed extraction of energy from the slow-wave structure, which is equivalent to loss insertion. This enables beam capture by the wave and protracted synchronous acceleration of particles in the braking phase, resulting in asymptotically total extraction of energy. The author constructs an asymptotic theory of emission of an electron beam in the capture region on large interaction lengths. It is shown that under optimum conditions, the efficiency of emission may approach 100 percent. The conclusions are confirmed by numerical modeling. The work was done with the support of International Science Foundation grant No M4D000. Figures 4, formulas 10, references 8.

Russia: Conditions of Self-Mode Locking in Semiconductor Injection Laser with External Cavity

964D0945E Nizhny Novgorod IZVESTIYA VUZOV: RADIOFIZIKA in Russian Nov 95
Vol 38 No 11, pp 1204-1212

[Article by V. A. Yurevich, Institute of Applied Optics, Belarus Academy of Sciences, Mogilev; manuscript received 2 Mar 94; UDC 621.378.324]

[FBIS Summary] The paper gives results of an analytical-computational study of particulars of the time structure of CW-pumped injection lasers with allowance for the refraction nonlinearity observed in

GaAs-based optical semiconductors. Qualitative analysis of the system of dynamic equations for the light field and inverse population of a laser diode optically matched to an external cavity shows that self-mode locking can be achieved without using auxiliary modulating devices only by means of a self-modulation effect associated with nonlinearity of the active layer of the laser diode. Figures 3, formulas 3, references 9.

Russia: Nikolay Nikolayevich Korchemkin (3 Mar 1912-30 Dec 1989)

964D0847A Moscow TRUDY TSENTRALNOGO AEROGIDRODINAMICHESKOGO INSTITUTA IMENI PROFESSORA N. Ye. ZHUKOVSKOGO in Russian No 2568, 1995 pp 3-5

[Unsigned article]

[FBIS Summary] A brief biography of Nikolay Nikolayevich Korchemkin. He was born in Nizhny Novgorod on 3 March 1912, graduated from secondary school in Moscow in 1930, and entered a construction engineering institute. He left the institute in his senior year in 1933, and began working at the Central Aerohydrodynamics Institute, where he spent his entire creative life. His work was concentrated in the area of developing standards for the strength of manned and unmanned flight vehicles. He was awarded a State Prize in 1970 for work on ballistic missiles. In his later years he helped to develop strength standards for the Buran aerospace vehicle. He was a member of a team that was awarded the First Zhukovskiy Prize for work in developing aircraft strength standards.

Russia: Composites in Prewar Aircraft

964D0847B Moscow TRUDY TSENTRALNOGO AEROGIDRODINAMICHESKOGO INSTITUTA IMENI PROFESSORA N. Ye. ZHUKOVSKOGO in Russian No 2568, 1995 pp 6-8

[Abridgment of report at 1987 seminar in Moscow Higher Technical Academy by N. N. Korchemkin (deceased)]

[FBIS Summary] A history of the use of composites in aircraft in the USSR dating from a 1935 directive prompted by the shortage of duralumin. Beginning in 1936, a number of steps were taken to refocus aircraft construction along the new lines: development of practical methods of determining the characteristics of plywood and sheet materials; derivation of formulas for critical tests of rectangular plates under various loading conditions; a study of the feasibility of using box longerons with skin working in shear; development and investigation of composites—akslid, balint, delta wood and fanelin.

Russia: Particulars of Setting Regulations for Design Conditions of Dirigible Strength

964D0847C Moscow TRUDY TSENTRALNOGO AEROGIDRODINAMICHESKOGO INSTITUTA IMENI PROFESSORA N. Ye. ZHUKOVSKOGO in Russian No 2568, 1995 pp 9-20

[Article by V. Yu. Yeremin and V. M. Chizhov]

[FBIS Summary] The authors consider the particulars of setting regulations for dirigible strength as compared with other types of flight vehicles. Design conditions of dirigible strength are compared in different normative documents: Temporary Strength Standards of 1936, British Standards of Flight Readiness, and Modern Dirigible Strength Standards. Difficulties of determining loads on dirigibles are analyzed. Figure 1, table 1, references 6.

Russia: Improving Methods of Calculating Loads on a Dirigible

964D0847D Moscow TRUDY TSENTRALNOGO AEROGIDRODINAMICHESKOGO INSTITUTA IMENI PROFESSORA N. Ye. ZHUKOVSKOGO in Russian No 2568, 1995 pp 128-135

[Article by V. Yu. Yeremin and S. V. Sotnikov]

[FBIS Summary] Equations are derived for approximate calculation of external aerodynamic loads for unsteady motion of a dirigible in moving air with allowance for entrained mass, as some components of the entrained mass tensor may amount to 90 percent of the mass of the dirigible itself. These equations can provide a basis for an effective method of determining loading of dirigibles when maneuvering and under the action of wind gusts. Formulas 9.

Russia: Evaluating Parameters of Sea Waves from SAR Image Spectra Taken at Different Satellite Orbit Altitudes

964D0842A Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 3, May-Jun 95 pp 47-55

[Article by K. Ts. Litovchenko, M. D. Rayev, S. S. Semenov, K. S. Etkin (deceased), V. V. Zaytsev, A. Yu. Ivanov and V. Alpers, Institute of Space Research, Russian Academy of Sciences, Moscow; Scientific Production Association of Machine Building, Reutov, Moscow Oblast; Institute of Oceanography at Hamburg University; manuscript received 22 Dec 94; UDC 551.446.8:629.78]

[FBIS Summary] While the European ERS-1 and the Russian Almaz-1 were in orbit, several surveys of the sea surface were conducted that were coordinated in time and space using special satellite-borne synthetic-

aperture radars. The purpose was to study mechanisms of imaging sea surface features, including waves of the sea. Previous publications have described the results of two specially planned joint survey experiments conducted in the North Atlantic in October 1992. The authors now analyze the data of four other surveys done in 1991-1992, and summarize the results of all observations. An analysis is made of the expanded statistics of the experimental data, and this is used as a basis for studying the conclusions that have already been drawn about differences in imaging of sea waves by the two satellite-borne radars. It is shown that divergence in determining the azimuthal component of the wave vector increases as this component increases due to amplification of "azimuthal cutoff" of the spectrum in accordance with the mechanism of "velocity grouping," the ERS-1 SAR giving understated estimates of this component as compared with Almaz-1. The same divergence, but for the component of the wave vector in the range direction, is considerably less and is almost independent of its magnitude, since for waves propagating near the range direction, the effect of modulation of the actual specific effective cross section prevails over "velocity grouping." The relative error in determination of the wave vector increases with increasing ratio of the parameter R/V (where R is slant range, and V is satellite velocity) for the ERS-1 to the value of this parameter for Almaz-1, as "velocity grouping" effects increase with increasing R/V . It is concluded that the influence of effects that arise due to motion of the sea surface during synthesis can be minimized by selecting a carrier for the SAR with high resolution and low orbit. The Almaz-1 satellite fits these conditions in a first approximation. The study was funded by the Russian Fundamental Research Foundation (grant No 94-02-05880-a). Figures 4, tables 2, references 5.

Russia: Analysis of Kinematic Mechanism of Mapping Internal Ocean Waves on Satellite SAR Images

964D0842B Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 3, May-Jun 95 pp 56-63

[Article by I. G. Maltseva, M. N. Marov, N. S. Ramm, V. R. Fuks and A. Yu. Ivanov, Russian State Hydrometeorological Institute, St. Petersburg; St. Petersburg University; Scientific Production Association of Machine Building, Reutov, Moscow Oblast; manuscript received 2 Feb 95; UDC 528.873:041:551.465]

[FBIS Summary] The authors analyze a kinematic mechanism of mapping internal waves in SAR imaging by using the effect of restructuring of the spectrum of short gravitational-capillary waves in the velocity field on the sea surface that is set up by internal

waves. It is shown that this mechanism in many cases can show internal waves not only on satellite radar images obtained in the decimeter band, but also on the radar images of the Almaz-1 and ERS-1 satellites that operate in the centimeter band. These radar survey satellite systems are equally suitable for remote study of internal waves; however, they do not nearly always register them. The qualitative analysis is illustrated by calculations done in application to synthetic aperture radars of the Sensat, ERS-1 and Almaz-1 satellites. Table 1, formulas 15, references 12.

Russia: Evaluating Contrasts of Oil Slicks on the Ocean Surface that are Observed from Satellites in the Visible Band of the Spectrum

964D0842C Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 3, May-Jun 95 pp 64-72

[Article by A. P. Vasilkov, T. V. Kondranin and A. A. Shcherbakov, Moscow Physicotechnical Institute; Institute of Oceanology imeni P. P. Shirshov, Russian Academy of Sciences, Moscow; manuscript received 5 Oct 94; UDC 551.463.5:551.521]

[FBIS Summary] The authors consider the feasibility of improving the probability of detecting oil slicks on the ocean surface by observing the same area from different directions. Based on their research within the scope of a physical-mathematical model of transformation of solar radiation in the system that includes the ocean surface (oil slick) and atmosphere, it is concluded that the optical contrast between background and slick is appreciably dependent on angle, especially in the range of angles close to the direction of mirror reflection of direct sunlight. There are also bands of angles characterized by zero contrast due to equality of the difference between the radiation reflected from oil and water on the one hand, and radiation emanating from beneath the water on the other. The optimum probing geometry is determined in different spectral ranges for various types of water and atmosphere. Directions of probing close to the region of the solar track, and directions that are not too flat for azimuthal angles in the range of 90-180° are more preferable than probing toward the nadir. The most informative spectral bands for observing oil slicks are the region close to 500 nm that corresponds to the maximum of radiation emanating from beneath the water, and the infrared region of the spectrum near 800 nm, where there is practically no radiation from under the water. The type of ocean water has a considerable effect on contrast far from the region of the solar track, except for the infrared band of the spectrum. Figures 6, formulas 15, references 13.

Russia: Using Satellite Information to Study Block Tectonics of the Chardzhou Platform

964D0842D Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 3, May-Jun 95 pp 73-80

[Article by Yu. N. Gololobov, All-Russian Scientific Research Institute of Satellite Aerological Methods, St. Petersburg; manuscript received 21 Oct 94; UDC 528.1:551.24+552.98(575.1)]

[FBIS Summary] The lateral structure of the base of the Chardzhou platform is established on the basis of analysis of satellite photographs. It is shown that the Chardzhou platform is enclosed in a rigid framework of fractures of northwest strike that are characterized as right-hand heave faults, and is disjointed into blocks by an orthogonal system of disruptions: submeridional rents that are left-hand heave faults, and sublatitudinal shearing disruptions. A Pamuk-Kultak block is differentiated in the substructure that is formed by submeridional rents and is disjointed by sublatitudinal disruptions into small steps subsiding toward the south. Figures 5, references 7.

Russia: Signs of Convective Processes in Near-Water Layer of Atmosphere on Radar Images of Sea Surface

964D0974A Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 1, Jan-Feb 96 pp 3-14

[Article by Yu. A. Kravtsov, M. I. Mityagina, V. G. Pungin and V. V. Yakovlev, Institute of Space Research, Russian Academy of Sciences, Moscow; manuscript received 31 Aug 95; UDC 528.873.044.1]

[FBIS Summary] The paper discusses images recorded by side-looking radar on a wavelength of 2.5 cm under conditions where the ocean was warmer than the atmosphere, and the reflections of cellular convection on these images. The study materials were acquired in the course of a joint Russian-U.S. experiment to study internal waves in the ocean (JUSREX) in June of 1992, and at a test site in the North Atlantic southeast of Long Island previously used in the SARSEX Experiment. It is shown that stratification of the boundary layer of the atmosphere has a considerable effect on radar images of the sea surface. Analysis of images with vertical polarization of the probing beam reveals the nature of stratification of the boundary layer of the atmosphere. This is extremely important, as today's models of reconstruction of specific parameters of the state of the ocean and energy exchange in the ocean-atmosphere system from remote sensing data is strongly dependent on stratification of the boundary layer. It is found that characteristic cellular structures are present

on radar images obtained during unstable stratification of the boundary layer of the atmosphere, and do not show up on images obtained under conditions of stable stratification. The authors consider the possibility of observing dry and wet convection in the near-water layer of the atmosphere. Comparison of radar images of the sea surface in the centimeter band on VV and HH polarizations enables classification and differentiation of sources of modulation of a radar signal as belonging to atmospheric or oceanic processes. The work was done with the financial support of the Russian Fundamental Research Foundation (grant 95-02-03623). Figures 6, references 15.

Russia: A Study of Specific Features of Satellite Doppler Method of Measuring Dynamic Characteristics of Cloudy Atmosphere

964D0974B Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 1, Jan-Feb 96 pp 26-33

[Article by A. S. Fedulov, Smolensk Affiliate, Moscow Power Engineering Institute; manuscript received 6 Jun 95; UDC 528.8.044:502.58]

[FBIS Summary] Expressions are derived and analyzed for the relation between statistical errors in estimates of primary characteristics of the atmosphere and the parameters that determine the system comprising the measurement device (radar) and the probed object with allowance for the specifics of Doppler probing of the cloudy atmosphere from a satellite platform. A numerical example is considered. It is shown that accuracy can be most effectively improved by increasing antenna diameter. The results given in the paper can be used on the stage of preparation of a physical experiment in radar design, and in engineering its optimum parameters. Figure 1, formulas 9, references 4.

Russia: Fractal Model of Optoelectronic Satellite Images

964D0974C Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 1, Jan-Feb 96 pp 56-61

[Article by Ye. P. Markov, Military Engineering Space Academy imeni A. F. Mozhayskiy, St. Petersburg; manuscript received 11 Jul 95; UDC 528.873.044.1]

[FBIS Summary] The paper describes a fractal model of Levi motion. The applicability of this model to optoelectronic satellite images is studied. The experimental procedure and basic results are given. It is shown that the averaged distribution of increments in brightness of satellite images given by the model is approximated by four-parameter steady-state α -distribution, showing the feasibility of using the model of Levi motion to represent optoelectronic satellite images. The use of this

model enables allowance to be made for the degree of correlation of samples of image brightness, and the presence of natural and man-made objects. Hence, a quantitative evaluation can be made of the degree of inhomogeneity of observed objects, and image quality can be studied. The model also demonstrates high sensitivity to statistical characteristics of observed images. Figures 3, formulas 3, references 8.

Russia: Results of Experimental Study of the Possibility of Precision Measurement of Ground Surface Relief by Interference Method from Satellite SAR Data

964D0974D Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 1, Jan-Feb 96 pp 75-90

[Article by I. V. Yelizavetin and Ye. A. Ksenofontov, Machine Building Scientific Production Association, Reutov, Moscow Oblast; manuscript received 6 Apr 95; UDC 528.873.044.1]

[FBIS Summary] The paper gives the results of analysis of phase fields obtained in the course of processing echo signals of radar probing of the surface of the earth by Almaz-1 satellite SAR. The authors describe methods of interferometric processing of a pair of radar images acquired by sequential scanning of the same section of terrain on different orbital loops with similar parameters. Results of interpretation of interference patterns are given with allowance for the main characteristics of the laser signal and generalized parameters of the observed section of terrain. Estimates are made of the potential possibility of reconstructing relief altitudes from an interferogram of the surface, and the level of reconstruction errors with allowance for phase noises. To eliminate phase noises, and hence acquire precision data about the altitude component of ground relief, an orbital interference system has to be developed that provides simultaneous surface imaging by two radars separated by an interference base of the order of hundreds of meters. Figures 8, formulas 17, references 5.

Russia: Characteristics of Spacecraft Engines Applying Principle of Adiabatic Heating of Working Medium

964D0792A Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Jan 96 No 1, pp 11-14

[Article by V.V. Glazkov and O.A. Sinkevich, Moscow Power Institute; (manuscript received 20 Jan 95) UDC 536.8]

[FBIS Summary] A new design principle is proposed for spacecraft engines. High-temperature heating of the

working medium is attained by its adiabatic compression by a high-velocity piston. The operating principle for such an engine is that first proposed by S. Ramsauer (PHYS. Z., Vol. 34, p 890, 1933). It is shown that the pressure in front of the piston may attain 100 MPa when the medium temperature is about 10,000 K. When using hydrogen as the working medium its escape velocity from the engine nozzle may attain 15 km/s, but when using ammonia — up to 10 km/s. Two piston propulsion variants are examined in detail: adiabatic heating with pneumatic piston propulsion (for low-thrust engines) and adiabatic heating with electromagnetic piston propulsion (for sustainer engines). The proposed method for heating the working medium, despite its simplicity, enables the engines using it to attain very high specific parameters. The great advantage of adiabatic heating over other methods is its equilibrium character. There also are no fundamental technical difficulties involved in developing adiabatic heating engines with a mean thrust F up to about 1,000 N. However, the problems with erosion of the piston and nozzles, especially with their prolonged operation, require careful research. If the erosion is within acceptable ranges, an adiabatic heating engine can be regarded as very promising for interplanetary flights and especially for manned flights to Mars. Figures 6; references 9: 1 Russian, 8 Western.

Russia: Nonlinear and Linearized Equations of Motion of Elastic Space Structures

964D0912A Moscow IZVESTIYA ROSSIYSKOY AKADEMII NAUK: MEKHANIKA TVERDOGO TELA in Russian Jan 96 No 1, pp 161-175

[Article by F. N. Shklyarchuk, Moscow; manuscript received 9 Aug 95; UDC 629.78:534.1]

[FBIS Summary] Large space structures are assembled or deployed in orbit. They operate under near-vacuum conditions in weightlessness, are subjected to light loads, and therefore may be very flexible. The acting loads, and also gravity and acceleration, especially in rotating motion, may have a considerable effect on the elastic and dynamic characteristics of such structures, and as a result on their dynamics. This effect in the general case of unsteady motion may be correctly accounted for only on the basis of a geometrically nonlinear theory of strain of an elastic body, even if elastic displacements are small. However, in most published papers, displacements are determined on the basis of the linear theory of elasticity, which is valid only for comparatively rigid structures. In this paper the author considers the dynamics of space structures in a central gravitational field at large angles of rotation with finite elastic deformations. General nonlinear equations of motion are derived with accuracy to quadratic terms

relative to generalized coordinates that represent elastic deformations. Linearized equations of perturbed motion of the given elastic system are also derived. The work was done with the financial support of the Russian Fundamental Research Foundation (project code 93-013-16490). Figures 7, formulas 41, references 7.

Russia: Model of Global Distribution of Rocket Engine Exhaust Gases in Upper Atmosphere

964D0955A Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 34 No 1, Jan-Feb 96 pp 30-35

[Article by M. N. Vlasov, Institute of Applied Geophysics, Moscow, and V. V. Grushin, Moscow State Institute of Electronics and Mathematics; manuscript received 19 Jul 95; UDC 533.6.011]

[FBIS Summary] Models have been developed in previous research that describe the dispersal of clouds of exhaust gases in the upper atmosphere in times of less than an hour, corresponding to relaxation to the background level for exhaust masses ranging from a few kilograms to ten kilograms. In this paper, based on the approach used in developing these models, the authors construct a new model that describes diffusion dispersal of a gas cloud massing tens of metric tons occurring in the upper atmosphere as a result of rocket engine operation. Relaxation of such a mass to the background level of the natural environment extends to ten or more days, and covers global scales. The proposed model describes the dynamics of both heavy and light gases for which escape from the upper atmosphere into the geocorona is significant. The space-time distributions of hydrogen and carbon dioxide are calculated for specific conditions of discharge. It is found that light gases like hydrogen, are typified by large-scale propagation with a simultaneous decline in overall concentration due to escape, which increases with increasing solar activity. Thus, the maximum accumulation of light gas in the upper atmosphere as a result of periodic emissions occurs when solar activity is low. Under such conditions, the fraction of hydrogen from rocket exhaust may reach ten percent or more on a global scale. Emissions of heavy gases like carbon dioxide are also sensitive to helio-geophysical conditions due mainly to change of the molecular coefficient of diffusion. A heavy gas occupies a smaller spatial scale than a light gas for the same relaxation times. However, its accumulation in the case of periodic emissions is directly proportional to the number of emissions, and may be limited only by photochemical dissociation. For carbon dioxide, the characteristic time of photodissociation by solar ultraviolet radiation is 60 days, i.e. CO_2 may accumulate in the upper atmosphere for this length of time. Calculations show that in such a

case the dimensions of the CO₂ cloud may reach a thousand km or more, and its concentration will be in the tens of percent with respect to the background. Figures 8, table 1, formulas 8, references 9.

Russia: Evolution of Fast Rotations of Viscoelastic Satellite in Circular Orbit

964D0955B Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian
Vol 34, No 1, Jan-Feb 96 pp 58-65

[Article by B. S. Bardin, Moscow Aviation Institute; manuscript received 14 Jul 94; UDC 539.3:534.1]

[FBIS Summary] The author considers motion of a space vehicle relative to a center of mass in a central Newtonian gravitation field in a circular orbit. The vehicle is represented by a viscoelastic solid with transverse dimensions much less than its longitudinal dimensions, and flat in shape in the absence of elastic deformations. Dissipative forces that arise with relative displacements of the elements of the body are selected in the form of forces of viscous friction and are assigned by a dissipative Rayleigh function [1]. It is assumed that the body has high rigidity, and that dissipative forces are small compared with elastic forces. Evolution of the motion of the body is considered in the case where its angular velocity is much greater than the average motion of the center of mass in orbit. The analysis is done within the scope of the linear theory of elasticity. Analysis of the case of rapid rotations of a thin viscoelastic inextensible homogeneous circular ring with attached material point shows that for almost all initial conditions, rapid rotations evolve with increasing time in such a way that the limiting motion is rotation relative to the axis perpendicular to the plane of the ring and lying in the plane of the orbit of the center of mass of this ring. The author thanks A. P. Markevich for constructive criticism and interest. The work was done with the financial support of the Russian Fundamental Research Foundation (93-013-16257) and the International Science Foundation (MFG 000). Figures 3, formulas 46, references 10.

Russia: Stabilization of Spacecraft Attitude by Two Flywheel Controllers

964D0955C Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian
Vol 34 No 1, Jan-Feb 96 pp 66-72

[Article by V. P. Stalkov, Institute of Informational Technologies and Applied Mathematics, Siberian De-

partment, Russian Academy of Sciences, Omsk; manuscript received 6 Dec 93; UDC 519.71]

[FBIS Summary] The author considers the application of a series of criteria of exponential stability differing from the Routh-Hurwitz determinant to steady and near-steady state control systems in the problem of stabilizing spacecraft attitude. Direct, indirect and mixed spacecraft motion control options are analyzed. It is shown that feedback may be used in the mixed option. In this case there is no need to observe the velocity characteristics of the system, replacing the procedure of differentiating observational data with a procedure of integration via the indirect control option. Based on the example of a spacecraft model with two flywheel controllers, it is demonstrated that eccentric oscillations of the spacecraft can be subdued. This is done by bringing about appropriate conditions of rotation of one of the flywheel controllers. Figure 1, formulas 21, references 9.

Russia: Determining Dynamic Characteristics of Elastic Space Vehicle in Vibration Tests

964D0955D Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian
Vol 34 No 1, Jan-Feb 96 pp 87-93

[Article by V. R. Aminov, Central Scientific Research Institute of Machine Building, Kaliningrad; manuscript received 26 Oct 94; UDC 629.7]

[FBIS Summary] In a previous paper, this author has studied the problem of oscillations of spacecraft structures held by springs and cables in vibration tests. Expressions were derived for determining the natural frequencies and normal modes of an elastic spacecraft, allowing for the influence of restoring and inertial forces acting on the part of the holding system. Damping of spacecraft oscillations was not considered. At the same time, it is extremely important to consider dissipative forces, as they have a direct effect on the nature of perturbed motion of a spacecraft, and especially on the stability of its oscillations. This paper examines the oscillations of a space vehicle with allowance for dissipation of energy in its structure, and in the components of the spring-and-cable suspension. A method is proposed for determining the natural frequencies, normal modes and decrements of oscillations of the structure that accounts for the way that they are influenced by restoring and inertial forces on the part of a suspension system (not necessarily of spring-and-cable type) as a result of varying its parameters. It is shown that by repeatedly varying the parameters of the suspension system, the accuracy of determining the sought characteristics can be improved by extrapolation of experimental data. Figures 2, tables 2, formulas 20, references 3.

Russia: Solid-Fuel Rocket Accident at Launch Site

964D0955E Moscow KOSMICHESKIYE

ISSLEDOVANIYA in Russian

Vol 34 No 1, Jan-Feb 96 pp 102-105

[Article by V. I. Romanov, Institute of Global Climate and Ecology, Russian Federal Service on Hydrometeorology and Environment Control, and Russian Academy of Sciences, Moscow; manuscript received 13 May 95; UDC 533.6.011]

[FBIS Summary] A detailed analysis of a possible solid-fuel rocket accident on the launch emplacement shows that the radius of the impact destructive effect of a solid-fuel rocket missing about 90 metric tons in a launch site accident exceeds 1.5 km. The explosion plume of toxic products of such an accident, depending on the state of the stability of the atmosphere, rises to an altitude of 1-3 km, contaminating a wide area. The main danger of the toxic effect of gaseous and aerosolic products of such an accident on the respiratory organs comes from near-ground gas and smoke emissions that are spread for many kilometers by the wind. Figures 2, table 1, references 3.

Russia: Aircraft Condensation Trails

964D0843A Moscow FIZIKA ATMOSFERY I

OKEANA in Russian

Vol 32, No 1, Jan-Feb 96 pp 5-18

[Article by I. P. Mazin, Central Aerological Observatory; manuscript received 1 Apr 94, after revision 20 Jun 94; UDC 551.574.2]

[FBIS Summary] An overview of research done by the late Aleksandr Khristoforovich Khrgian on the theory of formation of contrails, their evolution, and also the results of special experimental flights and military pilot questionnaire data. The research was done in cooperation with I. P. Mazin and the results can be found in publications that are not well known to most meteorologists. Appleman's diagram that enables determination of atmospheric conditions favoring the formation of contrails is extended to cases of arbitrary flight modes if aircraft engine efficiency is known. Expressions are given for estimating the lifetime of a contrail. It is concluded that the mechanism of formation of contrails is indeed mixing of engine exhaust gases with the cold atmosphere. Contrails form in the temperature range from -44 to -40°C, which depends considerably on altitude and humidity. Contrails are seen in winter and spring, and less often in summer. Contrails in the temperate latitudes have been most often seen at altitudes of 10-11 km. Repeatability has declined rapidly above this zone, and more slowly beneath it. The few reports of contrails at altitudes as

low as 2-4 km are of doubtful veracity. It is predicted that as the efficiency of engines increases there will be more contrails and in a wider range of conditions. Preparation of this overview was funded in part by the International Science Foundation (grant RLV000). The author thanks colleagues of the Cloud Physics Laboratory at Central Aerological Observatory N. A. Monakhov, A. V. Ataman and L. V. Kuleshov for assistance in preparation of the manuscript. Figures 4, tables 7, formulas 27, references 8.

Russia: Determining Coefficient of Turbulent Inter mixing in Atmosphere from Data of Measurements Aboard Aircraft

964D0843B Moscow FIZIKA ATMOSFERY I

OKEANA in Russian

Vol 32 No 1, Jan-Feb 96 pp 35-41

[Article by M. A. Strunin and S. M. Shmeter, Central Aerological Observatory; manuscript received 26 Jan 94, after revision 26 Apr 94; UDC 551.551.5]

[FBIS Summary] The authors study various methods of calculating the coefficient of eddy viscosity (K) from data about wind pulsations as measured on a flying laboratory. They find a discrepancy between the values of K calculated by the Richardson-Obukhov and Lyapun formulas and by a "base" method in which the coefficient K is itself determined. The reasons for the observed discrepancies are discussed. A modification of the Lyapun formula is proposed in which the average time of retention of the sign of pulsations (ΔT_0) is computed from data about pulsations of the vertical component of wind speed, while the standard deviations of pulsations σ_w and σ_u are computed from the spectra of pulsations for a set scale range. The maximum error of results of calculations by the modified formula is about 60 percent. It is shown how the coefficient of eddy viscosity depends on the range of wave numbers (scales) of pulsations. Figures 3, table 1, formulas 16, references 11.

Russia: Measurement of Humidity Fluctuation Spectrum by Laser-Acoustic Hygrometer

964D0843C Moscow FIZIKA ATMOSFERY I

OKEANA in Russian

Vol 32 No 1, Jan-Feb 96 pp 63-67

[Article by V. V. Vorobyev, A. S. Gurvich, V. A. Myakinin and Yu. M. Golembiovskiy, Institute of Physics of the Atmosphere, Russian Academy of Sciences; manuscript received 3 March 94, after revision 28 Jun 94; UDC 551.501.551.551.8]

[FBIS Summary] The authors look at possibilities for measuring the spectra of turbulent fluctuations of hu-

midity by using a laser-acoustic hygrometer (LAH) based on measurements of the fluctuations of amplitude of sound generated when Q-switched carbon monoxide laser emission is absorbed in air. Conditions are formulated under which LAH measurements can determine the spectra of humidity fluctuations in small spaces with characteristic dimensions of the order of a centimeter. In this context, an important advantage of the proposed instrument is that it does not have to be calibrated when measuring relative humidity fluctuations, and when fluctuations of absolute humidity are being determined, it is only necessary to make routine measurements of the average value. An experimental facility is developed, and measurements are made of the frequency spectra of humidity fluctuations in the atmosphere. The authors thank E. N. Lotkova and V. I. Marychev for providing equipment for the measurements and discussing the results, and also G. M. Kruchenitskiy for constructive criticism in reviewing the article. The work was financed by the Russian Fundamental Research Foundation, project No 93-02-15463. Figures 2, formulas 9, references 10.

Russia: Coevolution of Short and Long Surface Gravity Waves Described by Zakharov's Equation

964D0843D Moscow *FIZIKA ATMOSFERY I OKEANA* in Russian
Vol 32 No 1, Jan-Feb 96 pp 75-83

[Article by V. A. Kalmykov; manuscript received 14 May 93; UDC 551.466]

[FBIS Summary] The author considers a possible mechanism of interaction of long and short waves. Because of the awkward calculations, the model consists of only six wave modes (three long and three short), and is described by a modification of Zakharov's equation that includes five-wave interaction. An equation for "fast variables" that includes Zakharov's equation as "slow variables" is used to account for three-wave interactions. It was found that long and short waves interact with each other mainly within their own families that are formed from short and long waves. These are four-wave interactions. If five-wave interactions are added, then they merge the two families of waves, but evolution of the waves in this case is close to that of the preceding case, as the five-wave interactions are weak. It was noted that at times of destabilization of long waves by four-wave interactions, groups of short waves are formed and the amplitude modulation of these waves increases due to five-wave interaction. Accounting for three-wave interactions gives stronger coupling of two-wave families than five-wave interaction. It amplifies modulation of short waves by long ones and distorts the evolution of long waves. Figures 3, formulas 5, references 10.

Russia: Scattering of Powerful Microwave Radiation in Visually Clear Atmosphere

964D0843E Moscow *FIZIKA ATMOSFERY I OKEANA* in Russian
Vol 32 No 1, Jan-Feb 96 pp 84-87

[Article by Yu. V. Bykov, Yu. A. Dryagin, A. G. Yermeyev, L. M. Kukin, Yu. V. Letskiy, O. S. Mocheneva and M. D. Tokman, Institute of Applied Physics, Russian Academy of Sciences; manuscript received 12 Apr 94; UDC 551.521.9:551.501.795]

[FBIS Summary] The authors give data of an experimental study of scattering of microwave radiation in a visually clear atmosphere. The equipment package used in the experiment included a powerful gyrotron oscillator with superhet receiver. The altitude profile of the coefficient of scattering of 3.6 mm emission was measured in the ground layer of the atmosphere (50-200 m). The received signal corresponds either to rather weak ground-layer turbulence (standard coefficient $C_n^2 = 10^{-12} \text{ cm}^{-3/2}$), or rarefied aerosol (for example a 100-150 μm particle in 10 cm^3). Scattering effectiveness decreases with increasing altitude of probing. The work was supported by the Russian Fundamental Research Foundation. Figures 5, formulas 7, references 10.

Russia: Role of Anisotropy of Curvature When Light is Reflected from Specular Points of Sea Surface

964D0843F Moscow *FIZIKA ATMOSFERY I OKEANA* in Russian
Vol 32 No 1, Jan-Feb 96 pp 147-151

[Article by A. N. Dubovik, Institute of Geology and Analytical Chemistry, Russian Academy of Sciences; manuscript received 26 May 94, after revision 22 Nov 94; UDC 551.46.07]

[FBIS Summary] The authors consider the problem of scanning the sea surface by a narrow light beam. It is shown that the intensity of reflected radiation is determined by the type of specular point (elliptical or hyperbolic), and depends both on the product of the main radii of curvature and on the coefficient of anisotropy that represents their ratio. In this connection, the statistics of the number of specular points as a function of signal level differs appreciably from the distribution with respect to radii of curvature. Figures 2, formulas 22, references 14.

Russia: Time-Dependent Petschek Reconnection (Overview)

964D0873A Moscow GEOMAGNETIZM I

AERONOMIYA in Russian

Vol 36 No 1, Jan-Feb 96 pp 1-17

[Article by V. S. Semenov, Physics Research Institute, St. Petersburg State University; manuscript received 28 Mar 94, after revision 7 Sep 95; UDC 550.385]

[FBIS Summary] Magnetic reconnection is a fundamental process in a plasma in which magnetic energy is converted to internal and kinetic plasma energy. Reconnection works in current layers; it is initiated in the diffusion region as a result of a drop in conductivity, or from any other cause that gives rise to an electric field locally in the plasma layer. The paper is a survey of research on magnetic Petschek reconnection, presenting in detail the simplest solution for time-dependent reconnection in the two-dimensional case in an incompressible plasma. The author considers the phases and basic properties of the process, the way that intensity and characteristic time of reconnection depend on conductivity of the medium. Magnetic reconnection is interpreted from various viewpoints. Facts are given about generalizations of the Petschek solution that have now been obtained. It is concluded that magnetic reconnection has clear advantages over purely diffusion models, and that the pulse mode in which the duration of reconnection is of the order of the diffusion time is more effective than the original steady-state Petschek mechanism. The author thanks R. P. Raynbluk and M. I. Pudovkin for constructive criticism, and M. V. Kholeva for assistance in preparation of the article. The research was supported by the Russian Fundamental Research Foundation, grants 94-05-17268a and 93-05-9082, and by the Soros Science Foundation, grant NX3000. Figures 6, formulas 25, references 32.

Russia: Steady-State Reconnection at the Dayside Magnetopause

964D0873B Moscow GEOMAGNETIZM I

AERONOMIYA in Russian

Vol 36, No 1, Jan-Feb 96 pp 18-32

[Article by M. F. Khayn, Kh. K. Biyernal, R. P. Raynbluk, and I. V. Kubyshkin, Technical University, Graz, Austria; Space Research Institute, Graz, Austria; Department of Physics and Mathematics, Sussex University, Great Britain; Physics Research Institute, St. Petersburg University; manuscript received 28 Mar 94, after revision 10 Jul 95; UDC 550.385]

[FBIS Summary] The paper looks at interaction of the solar wind with the earth's magnetosphere from the standpoint of processes at the dayside magnetopause.

The most important of these is reconnection of magnetic lines of force of the interplanetary field and the magnetosphere. An analytical generalization of the Petschek reconnection model is constructed for conditions at the dayside magnetopause. Solution of the problem of magnetic reconnection is considered in three parts: the Riemann problem that gives components of the magnetic field and velocity that are tangential to the current layer, as well as plasma density, pressure and temperature; the problem of surface wave propagation along the current layer, from which the normal components of magnetic field and velocity are determined in the region of outflow; the problem of flow past a thin foil, from which MHD perturbation parameters are found in the region of outflow. The results are compared with experiment on a specific example. The authors thank V. S. Semenov for constructive criticism. The work was funded in part by the Russian Fundamental Research Foundation, grant No 94-05-17268a, and by the Soros Science Foundation, grant NX3000. Figures 5, formulas 31, references 38.

Russia: Remote Diagnosis of Parameters of Artificial Region of Perturbation and Regular Ionosphere When it is Modified by Powerful Radio Emission

964D0873C Moscow GEOMAGNETIZM I

AERONOMIYA in Russian

Vol 36 No 1, Jan-Feb 96 pp 85-92

[Article by N. V. Bakhmetyeva and Yu. A. Ignatyev, Nizhegorodskiy Radio Physics Reserch Institute; manuscript received 10 May 94, after revision 1 Jan 95; UDC 550.837.75]

[FBIS Summary] The paper gives the results of a study of backscattered signals from a region of artificial turbulence set up in the ionosphere by a field of intense radio waves in the RF band. It is shown that pulse signals on frequencies of 2-6 MHz are backscattered by artificial inhomogeneities of electron concentration with transverse dimensions of 100-500 m relative to the geomagnetic field and relative deviations of concentration reaching $(1-5) \times 10^3$. Such inhomogeneities extend longitudinally for 2-4 km and move horizontally at average velocities of 100-120 m/s. Analysis of the statistical characteristics of the amplitude of backscattered signals from the perturbed region provided estimates of some parameters of the regular ionosphere at the altitudes of perturbation: electron concentration, coefficients of ambipolar diffusion and electronic thermal conductivity, and the ratio of characteristic scales of diffusion and thermal conductivity. Figures 3, references 15.

Russia: Dynamics of Energetic Electrons and Their Relation to RF Radio Emission of the Earth's Magnetosphere

964D0873D Moscow GEOMAGNETIZM I
AERONOMIYA in Russian
Vol 36 No 1, Jan-Feb 96 pp 93-102

[Article by A. V. Dudnik and Yu. V. Mineyev, Kharkov State University, Scientific Research Institute of Nuclear Physics, Moscow State University; manuscript received 23 Dec 94, after revision 28 May 95; UDC 523.165:523.75:550.388]

[FBIS Summary] The authors analyze measurements of fluxes of energetic electrons with $E_e = 0.3-2.0$ MeV on satellite Kosmos-1686 together with the intensity of background radio emission on frequencies of 38 and 326 MHz by a ground-based facility, and look at their behavior during a magnetic storm on 25 November 1986 ($D_{st} = -113$ nT). This paper gives the results of that analysis with allowance for the geophysical and heliophysical environment of that period. It was found that a long series of RF and SHF radio bursts in the earth's magnetosphere began over a wide spectrum of radio frequencies during the maximum of the storm. At the same time, there was an increase in the intensity of electrons with energies $E_e = 0.3-2.0$ MeV beneath the radiation belts, and the maximum of the inner belt was shifted with respect to the L -shells into the magnetosphere. Numerical estimates of the spectral density of synchrotron radiation flux of the electrons spilling out of the radiation belts in the earth's dipole magnetic field agree satisfactorily with the observed flux densities of sporadic radio bursts, given that the indices in the power-law energy and pitch-angle particle distributions lie in the ranges $\gamma = 1.5-3.0$ and $n = 4-5$. Comparison of the calculated coefficients of radial diffusion with the observed shift of maxima of the inner belt electron fluxes during the storm in the absence of pitch-angle diffusion showed that this diffusion is due chiefly to electric field fluctuations. The amplitude of these fluctuations must be at least 0.3 mV \times m $^{-1}$. Figures 3, tables 3, formulas 10, references 21.

Russia: Some Particulars of Behavior of Radio Noises in the 2-4 MHz Band During Remote Strong Earthquakes

964D0873E Moscow GEOMAGNETIZM I
AERONOMIYA in Russian
Vol 36 No 1, Jan-Feb 96 pp 183-187

[Article by A. M. Gokov and A. I. Gritchin, Kharkov State University; manuscript received 27 Dec 94, after revision 19 Jun 95; UDC 550.388.2]

[FBIS Summary] The method of partial reflections is used to study the effect of earthquakes in the time characteristics of radio noises on frequencies $f = 2-4$ MHz as a function of power, distance from the point of observation, location (underwater, on dry land) and depth of the earthquake. It is found that for earthquakes with energy $E < 10^{23}$ J, changes in the behavior of amplitude ΔA_{ω} are rarely observed ($<10\%$ of cases). For earthquakes with energy of about 10^{23} J or more occurring both on land and underwater, there is an abrupt increase by a considerable factor in radio noises on $f = 2-4$ MHz that is observed at the time of the earthquake and 2-4 minutes afterward with probability $W = 30-77\%$ (for various conditions). The probability of occurrence of a perturbation in the time behavior of ΔA_{ω} during a seismic tremor is 1.5-4 times higher on dry land than for underwater earthquakes. One possible mechanism for transfer of perturbations from earthquakes to global distances is MHD waves that may be excited and propagate in the ionospheric plasma at velocity $U \sim 100$ km/s. The authors thank N. A. Sergeyeva for assisting with earthquake data acquisition. Figures 2, table 1, references 13.

Russia: Identification of Neutrons Against Background of Gamma Quanta With Their Registry by Cal(Tl)-Based Detectors

964D0789A Moscow PRIBORY I TEKHNIKA
EKSPERIMENTA in Russian
No 1, Jan-Feb 96 pp 13-19

[Article by A.V. Bogomolov, G.I. Britvich, I.N. Myagkova, and S.P. Ryumun, Nuclear Physics Scientific Research Institute imeni D.V. Skobeltsyn, Moscow State University imeni M.V. Lomonosov; (manuscript received 15 Feb 95, revised 19 Jul 95) UDC 539.1.074.3]

[FBIS Summary] This experiment was conducted because of the growing interest in instruments capable of measuring energetic (10-1000 MeV) neutrons in space. The results of registering solar neutron flows on SMM and CGRO satellites demonstrate the high value of such experiments and their importance in understanding the

acceleration of solar flares and in ensuring radiation safety during space flights. A method for identifying neutrons against a background of γ -quanta on the basis of the form of the light impulse in a CsI(Tl) crystal is described. The particles were registered using a CsI(Tl) crystal 8 cm in diameter and height. In the first experiment the detector was positioned beyond the limits of the beam and registered the secondary neutral radiation formed in interactions between protons with energies about 2 GeV and a lead target. In this case the charged particles were separated by a scintillation counter positioned in front of the detector. In the second experiment the detector was positioned in a beam of protons with energies 20-400 MeV. Muons with energies about 800 MeV also were present in this beam. Data from measurements on the synchrotron of the High Energies Physics Institute were used in a more precise determination of the dependence of the form of the light impulse in CsI(Tl) on the specific ionization of the registered particles in the range dE/dx 1.5-200 MeV \times cm²/g and the dependence of the efficacy of separation of the electrons forming under the influence of γ -quanta and protons, the products of interaction with neutrons, on energy in the energy range 12-160 MeV. It is shown on the basis of the totality of the results in this study and data in the literature that the investigated method makes possible reliable separation of electrons and protons at proton energies from 1 to 140 MeV. Figures 5; references 30: 16 Russian, 14 Western.

Russia: Infrared Photometer for Observing Space Objects in Spectral Range 8-12 μ m

964D0789B Moscow PRIBORY I TEKHNIKA
EKSPERIMENTA in Russian
No 1, Jan-Feb 96 pp 110-114

[Article by V.L. Milovidov, Russian Space Instrument Making Scientific Research Institute; (manuscript received 21 Mar 95) UDC 621.384.3]

[FBIS Summary] Although various infrared photometers are described in the literature, all have shortcomings of one kind or another. An infrared photometer of the television type was therefore developed and constructed for use in photometry of radiation of low-orbit artificial earth satellites (AES) in the spectral range 8.5-11.9 μ m (field of view 20 \times 20)', free of the deficiencies in earlier instruments. It was used for the first time in September 1994 on Mount Maydanak in Uzbekistan in photometric registry of the thermal emission of the Mir orbital station. Two procedures which are employed in the IR photometer for discrimination of the signal from the background are described, as is the optimum signal filtration method. In developing the photometer, use was made of the optical-mechanical unit from high-resolution TV

equipment intended for registry of a thermal map of the Earth from aboard a spacecraft, coupled to a photodetector with a sensitivity an order of magnitude greater than in radiometers intended for registry of a thermal map of the Earth. The increase in sensitivity was attained due to the lesser background in the aperture angle and the stronger cooling of the photosensing elements. A block diagram of the IR photometer is given, together with a detailed description of its structure and functioning and the various steps involved in its preparation for operation. The results are exemplified in a frame showing information registered from the Mir at a distance 500 km. The threshold response of the IR photometer was determined from the signal-to-noise ratio registered during observation of Venus in the spectral range 8.5-11.9 μ m and was 4×10^{-14} W/cm². This signal from Venus was observed both at night and during the day. Figures 4; references 6: 3 Russian, 3 Western.

Russia: New Aid for Ephemeris Support of Planet Satellite Observations

964D0872A Moscow PISMA V
ASTRONOMICHSKIY ZHURNAL in Russian Feb 96
Vol 22 No 2, pp 153-156

[Article by N. V. Yemelyanov, State Astronomical Observatory imeni P. K. Shernberg, Moscow; manuscript received 26 May 95; UDC 521.835]

[FBIS Summary] An ephemeris support aid has been developed and is being distributed for practical use in observations of planet satellites. Instead of the conventional tables with computed coordinates of satellites at specific times, the coordinates are computed each time only when they are needed. A graphic user interface shows the user a window in which the planets and their satellites are displayed as they would be seen through a telescope. The window is surrounded by captions, comments and controls. The model telescope can be turned in all four directions, and magnification can be quickly changed. Panels next to the window show the direction of the telescope and its magnification. The sizes of bodies are shown in true scale. The ephemeris provides topocentric coordinates of the given planet, sun and moon, phases of the moon, occultations and eclipses, and calculates brightness changes. Data are computed by exact, approximate or graphic theories, depending on the specific satellite. The research was supported by the Russian Fundamental Research Foundation, grant No 93-02-17128.

**Russia: Global Model of Upper Atmosphere with
Variable Integration Step in Latitude**

964D0999A Moscow GEOMAGNETIZM /
AERONOMIYA in Russian
Vol 36 No 2, Mar-Apr 96 pp 89-95

[Article by A. A. Nangaladze, O. V. Martynenko
and A. N. Nangaladze, Polar Geophysics Institute,
Kola Science Center, Russian Academy of Sciences;
manuscript received 23 Jan 95, after revision 15 Jun
95; UDC 551.510.3]

[FBIS Summary] The authors develop a new version
of a global personal computer model of the thermo-
sphere, ionosphere and protonosphere of the earth with
elevated spatial resolution. An algorithm is constructed
for numerical solution of the modeling equations that
allows the use of a variable (latitude-dependent) inte-

gration step in latitude, thereby increasing the latitude
resolution of the model in latitude zones of interest.
Results are compared for model calculations of param-
eters of the ionosphere and thermosphere done with the
use of different integration steps in geomagnetic lati-
tude: a constant step of 2° for all parameters; constant
steps of 5° for parameters of magnetized ionospheric
plasma and 10° for parameters of the thermosphere of
the lower ionosphere; variable steps ranging from 2° in
the auroral zone to $5-10^\circ$ at the equator. It is found that
the use of variable integration steps in latitude saves
considerable computing time without significant loss of
accuracy of results. The work was done with the sup-
port of grants 94-05-17321 of the Russian Fundamental
Research Foundation and RLX 000 of the Soros Inter-
national Science Foundation. Figures 3, references 10.

Russia: Extension of the Laminar-Turbulent Transition with Intense Local Surface Heating Near the Front Edge of a Plate

964D0791A Moscow *TEPLOFIZIKA VYSOKIKH TEMPERATUR* in Russian Jan 96 No 1, pp 46-51

[Article by A. V. Kazakov, M. N. Kogan, V. A. Kuparev, Central Aerohydrodynamic Institute, Moscow; (manuscript received 1 Nov 94); UDC 532.526.5.013.4]

[FBIS Summary] This paper presents the results of numerical studies of the stability and position of the laminar-turbulent transition line in the boundary layer in intense heating of a section of the surface near the front edge of a plate. The surface downstream from the area of heating is presumed to be thermally insulated or radiating according to a σT^4 law. The position of the transition was determined from the linear theory of stability of plane-parallel flows and the well-known e^N method. It is shown that heating of a small area of the surface near the front edge to a temperature a factor of 2-4 higher than the temperature of the incident flow leads to extension of the transition even given thermal insulation of the surface of the body downstream from the heated region. Forced cooling is not necessary. An example is presented of the distribution of surface temperature at which energy savings due to reduced friction are a factor of three higher than the energy used to heat the surface. At moderate and large subsonic Mach numbers ($M_\infty > 0.8$) one can achieve substantial extension values. Figures 4; references 14: 9 Russian, 5 Western.

Russia: Computer Modeling of Nonsteady-state Thermophysical Processes in a Fuel Element in Loading

964D0791B Moscow *TEPLOFIZIKA VYSOKIKH TEMPERATUR* in Russian Jan 96 No 1, pp 57-62

[Article by A. N. Cherepanov, A. S. Basin, L. F. Meshcheryakova, B. G. Pokysayev, Institute of Thermal Physics, Siberian Division, Russian Academy of Sciences, Novosibirsk; (manuscript received 10 Jan 95); UDC 536.24.518.2]

[FBIS Summary] This paper presents a mathematical model of nonsteady-state thermophysical processes in fuel elements of water-cooled reactors with a consideration of the dependence of thermophysical properties of the material on temperature and phase transitions in the fuel and jacket. This model is used to develop a numerical algorithm and computer program. Phase transitions in the materials were considered. Complex heat exchange by radiation and molecular thermal conductivity in the gas gap was considered, as well as change due to temperature deformations of the fuel jacket. External

heat removal is assumed to be purely convective with a single-phase flow of coolant. Previous programs used to solve this type of problem are described (US programs RELAP-5 and TRAC and the Russian Kanal program). Numerical experiments were performed to study the dynamics of the change in temperature fields and thermal fluxes in the active material, the fuel element jacket, and the surrounding medium. Modeling yielded numerical data on the behavior of the fuel element in transition and steady-state modes for given laws and levels of heat release to melt-down of the fuel and the jacket with the formation of a two-phase zone. Figures 3; references 23: 14 Russian, 11 Western.

Russia: Operating Modes of a Magnetoplasma Macrobody Accelerator

964D0791C Moscow *TEPLOFIZIKA VYSOKIKH TEMPERATUR* in Russian Jan 96 No 1, pp 146-151

[Article by V. Ye. Ostashev, A. V. Ulyanov, S. N. Chuvashov, Joint Institute of High Temperatures, Russian Academy of Sciences, Moscow, Moscow State University; (manuscript received 20 Apr 95); UDC 533.9+537.523]

[FBIS Summary] The operating principles of railguns are described. Operating modes of a magnetoplasma macrobody accelerator (railgun) are defined. Factors limiting each mode are indicated. The electromagnetic operating mode is absolutely unstable and evolves into a magnetoplasmodynamic mode in which the decisive element is gas dynamic processes. The body is accelerated by gas pressure on the sides of the body created by a plasmodynamic discharge. Methods of verifying the operating mode of the railgun are found. Levels of energy consumption are presented in relation to the acceleration mode. The velocity of a macrobody is linked with the maximum velocity of the plasma flux accelerated by a ponderomotor force and the time that this affects the macrobody. The maximum length of the effect on the macrobody is calculated. Figures 4; references 16: 6 Russian, 10 Western.

Russia: Direct Penetration of a Group of Bodies into an Elastoplastic Medium

964D0911A Moscow *IZVESTIYA ROSSIYSKOY AKADEMII NAUK: MEKHANIKA TVERDOGO TELA* in Russian Jan 96 No 1, pp 80-87

[Article by Yu. K. Bivin; (manuscript received 4 Jan 94); UDC 539.374]

[FBIS Summary] This paper presents the results of an experimental study of the direct penetration by inertia into a elastoplastic medium of a group of bodies. The elements of the group are steel balls or cylindrical rods

of the target material or of metal powder. In the first case there is penetration of a group of solid bodies, in the remaining cases, deformed bodies. Several parameters are found which affect the penetration process. The similarities and differences in the depth and shapes of craters in the penetration of an individual body or groups of solid and deformed bodies are found. Two experiments with balls are described. In one, the balls are sent toward the target in single file. In the other the balls approach the target in layers. In the former, the size of the crater is not dependent on the number of balls, but on the speed of collision. The depth of penetration of the first ball depends on the initial speed, number of balls, and distance between them. In layered impact the shape of the crater is dependent upon the number of layers. In another experiment the central ball is replaced with a foam plastic cylinder. In penetration of a solid body the diameter of the crater is dependent only on the shape of the body and its speed. For a deforming body, the crater diameter is also dependent on mass, and for rods, on the length. When a solid body is replaced with a group of bodies of the same total mass, specific density, material and shape the depth of penetration decreases. Possible reasons for this are studied. Figures 12; references 4: 2 Russian, 2 Western.

Russia: Numerical Modeling of the Destruction of Structures with a Ceramic Layer in Dynamic Loading with Elongated Strikers

964D0911B Moscow IZVESTIYA ROSSIYSKOY AKADEMII NAUK: MEKHANIKA TVERDOGO TELA in Russian Jan 96 No 1, pp 114-123

[Article by S. A. Afanasyeva, A. N. Beloborodko, V. A. Grigoryan, V. F. Tolkachev, V. G. Trushkov; (manuscript received 16 Jun 94); UDC 539.3]

[FBIS Summary] Ceramic materials with a high impact hardness and small specific weight are promising composites for use in protective barriers where brittle ceramic layers should be combined with more plastic elements of construction. To select the optimal parameters of a protective barrier one must have complete information about the physics of the processes of piercing and destruction. The data can be obtained using numerical modeling of the impact interaction in conjunction with experimental data. This paper develops a model of a striker interacting with a layered barrier of steel and ceramic plates rigidly fastened along the side surface. To describe the stress-deformed state and destruction of interaction of bodies this paper uses an elastoplastic model of a medium considering a change in porosity, which is used as a measure of the damage to the material. A combined approach to the calculation of destruction is proposed which includes an explanation of two

types of material damage, separation (growth and fusion of micropores being pulled apart) and shearing (plastic deformation), as well as calculation of deformation and crushing of the destroyed material and the ejection of fragments. To numerically solve the problem the Euler method of calculation is used with a finite-difference MacCormack scheme and the markers method. Development of the destruction model is done in direct association with experiment with repetition of numerical calculations. Two types of barriers are modeled. Figures 9; table 1; references 6: 4 Russian, 2 Western.

Russia: Generation of UHF Radiation in a Long-Pulse Vircator with a Transverse Strip Beam

964D0785A St. Petersburg PISMA V ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian Jan 96 Vol 22 No 1, pp 16-20

[Article by A. Ye. Dubinov, V. S. Zhdanov, I. V. Kononov, I. V. Rozhnov, V. D. Seleznev, K. V. Shibaiko, Russian Federation Nuclear Center, All-Russian Scientific Research Center for Experimental Physics, Arzamas-16; (manuscript received 4 Sep 95)]

[FBIS Summary] In vircators, UHF devices with a virtual cathode, expanding plasma flares can greatly affect the formation of the electron beam. The case of long UHF pulses is considered, when the time for the plasma to cross the diode interval is comparable to the pulse length. Differing opinions on the best method of obtaining peak power are discussed. In the experiments described in this paper, an attempt was made to implement a biresonance mode between longitudinal (relative to beam propagation) vibrations of electrons in the cathode-virtual cathode potential well and transverse waves of bulk charge running along the virtual cathode. The area of formation of the virtual cathode is a low quality factor resonator which eliminates the effect of eigenmodes of the electrodynamic structure in the biresonance mode. The time to cross the diode gap was approximately equal to the pulse length, which corresponds to an average total speed of plasma flares of about 5 cm/ μ s. The peak power of UHF generation was 150 MW. The resonant frequencies sequentially excited in the system were 1.7 GHz, 3.2 GHz, and 4.2 GHz. Figures 3; references 7: 4 Russian, 3 Western.

Russia: Laser with Nuclear Pumping at Nitrogen Atom Transitions

964D0785B St. Petersburg PISMA V ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian Jan 96 Vol 22 No 1, pp 52-56

[Article by S. P. Melnikov, V. V. Porkhachev, Russian Federation Nuclear Center, All-Russian Scientific Re-

search Institute of Experimental Physics, Arzamas-16; (manuscript received 16 Oct 95)]

[FBIS Summary] Results obtained with various mixtures of inert and active gases for gas lasers with nuclear pumping are briefly outlined. This paper reports on quasi-continuous generation in nitrogen atom transitions ($\lambda = 859.4, 862.9, 904.6, \text{ and } 938.7 \text{ nm}$) in excitation of a Ne-N₂ mixture with the fission products of uranium. Some characteristics of the laser are presented. Nuclear pumping at high pressure is observed for the first time at 859.4, 904.6, 938.7 nm. The ²³⁵U nuclei are bombarded with neutrons to form fission products. The structure of the laser equipment is described. Figures show the pulse of thermal neutrons and generation pulses in individual lines at 720-1100 nm at neon pressures of 10 kPa and 40 kPa. The dependence of generated power on neon pressure is illustrated in individual lines. The power characteristics recorded in the lines indicated above are three orders of magnitude higher than those obtained by other researchers with a nuclear pumped laser using nitrogen atom transitions. Figures 2; table 1; references 14: 5 Russian, 9 Western.

Russia: Results of Studies of Nonequilibrium UV Radiation Due to a Strong Shock Wave

964D0784A St. Petersburg PISMA V ZHURNAL
TEKHNICHESKOY FIZIKI in Russian Jan 96
Vol 22 No 2, pp 28-31

[Article by M. K. Gladyshev, V. A. Gorelov, A. Yu. Kireyev, V. G. Chebureyev, Central Aerohydrodynamic Institute, Moscow; (manuscript received 25 Sep 95)]

[FBIS Summary] There has been great interest in the nonequilibrium radiation of a hypersonic viscous shock layer around aerospace vehicles. Numerical models of nonequilibrium processes of radiation have been developed for a wide range of changes in altitude and flight speeds. However, it is difficult to experimentally verify these models. A step-by-step method is proposed in which a kinetic model of radiative processes is verified in a model of a direct shock wave. The verified kinetic model may then be used to calculate radiation in a viscous shock layer model which can then be tested in special experiments at a fixed flight speed. This paper presents a brief description of the results of a wind tunnel experiment to study the characteristics of nonequilibrium radiation in the ultraviolet behind a strong shock wave propagating in air at speeds of 5-10 km/s. In the experiment the pushing gas was high-temperature helium. Dried air was the working gas pumped continuously at low pressure into the wind tunnel. The experiment measured the change in intensity of radiation in relation to the time since the passage of a shock wave front $I_{\lambda}(t)$ at $\lambda = 200-400 \text{ nm}$, in particular

in the NO(γ) system, the N₂⁺ (1-) system and the CN system). There is a clear peak in the nonequilibrium radiation at the shock wave front 5-10 times higher than the quasi-equilibrium level of radiation behind the shock wave. Numerical and experimental results are compared. Figures 2; references 5 (Western).

Russia: Microband UHF Channel Switch and Phase Shifter Based on High-Temperature Superconducting Films

964D0784B St. Petersburg PISMA V ZHURNAL
TEKHNICHESKOY FIZIKI in Russian Jan 96
Vol 22 No 2, pp 42-45

[Article by M. M. Gaydukov, A. B. Kozyrev, V. N. Osadchiy, St. Petersburg State Electrotechnical University; (manuscript received 29 Sep 95)]

[FBIS Summary] This paper describes the microband integrated circuits of a UHF two-channel switch and a UHF phase shifter for use in switched lines using linked S-N switch elements based on high-temperature superconducting films of YBa₂Cu₃O_{7-x} on sapphire. The S-N switch elements were a single-component meander 30 μm wide with a total length of 1.5 mm. The topology of the switch and phase shifter are shown in figures. In the S state the UHF signal was virtually completely reflected, and in the N state the signal is passed without reflection. The passband at the 0.5 dB level for an open channel and the cut-off of the channel at the 25 dB level for a closed channel are on the order of seven percent. Dissipative losses could be reduced by making all microband structures of high-temperature superconducting films. It is shown that it is possible to use these films to make S-N switches for UHF devices with current control. The circuits used here can be used in the design of monolithic circuits based on high-temperature superconducting films. The use of linked elements can result in circuits for the low end of the UHF range (1 GHz and below). Figures give the amplitude-frequency and phase-frequency characteristics of the UHF phase shifter. The switching time did not exceed 20 ns and was determined not by the maximum speed of the current-driven N-S switch (~0.1 ns) but by the pulse control current. Figures 4; references 3 (Russian).

Russia: Resonant Method of Detecting Infrared Radiation

964D0783A St. Petersburg PISMA V ZHURNAL
TEKHNICHESKOY FIZIKI in Russian Feb 96
Vol 22 No 3, pp 73-77

[Article by A. S. Rudyy Yaroslav State University;
(manuscript received 24 Nov 96 [sic])]

[FBIS Summary] This paper provides the theoretical basis for a new means of increasing the sensitivity of a bolometer by increasing the quality factor of the relaxation system via temperature feedback. A mathematical model is constructed for an infrared receiver. The receiver consists of two thin-film thermal resistors on a dielectric substrate over a thermostatically-controlled copper base. The thermally-sensitive elements and resistor form a bolometric bridge with a preamplifier. The incident light is modulated as it enters the receiver. The mathematical model has the form of a nonlinear boundary problem. The model presented is very similar to one presented by the author in the International Journal of Thermophysics (Vol 14 No 1, 1993 pp 159-172). Calculations result in a boundary problem to determine the oscillating component of temperature. The range in which the solution is valid is determined. The cases of active and passive bolometers are considered. It is shown that the introduction of feedback increases the detection capability of a passive bolometer. Possible areas of application of this model are the development of new infrared receiving devices for remote control, aerial surveying, detection, tracking, recognition, night vision, and infrared spectroscopy. Figures 3; references 3; 2 Russian, 1 Western.

Russia: Study of the Properties of Acceleration of Macroparticles in a Magnetoplasma Accelerator

964D0752A Novosibirsk PRIKLADNAYA
MEKHANIKA I TEKHNICHESKAYA FIZIKA
in Russian No 1, Jan-Feb 96 pp 15-20

[Article by A. V. Plekhanov, A. V. Kudryavtsev,
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Production Association "Soyuz", Dzerzhinskiy,
Moscow oblast; (manuscript received 30 Dec 94); UDC
533.92:621.384]

[FBIS Summary] This paper presents the results of experimental studies of the initiation of an arc and formation of a plasma piston in relation to the initial speed of the macroparticle and the behavior of the plasma piston as the current gradient of the magnetoplasma accelerator circuit changes. A very simple initiator provides stable formation of a plasma piston with an initial speed of up to 700 m/s. A "duet" body was then tested. It consists of two parts, a macroparticle with an initiator, and an aux-

iliary piston with a mass that is a factor of 2-5 greater than the mass of the macroparticle. Between them is a wadded plug. Stable initiation and formation of a plasma piston was obtained at initial speeds of up to 1100 m/s. These processes become unstable above 1100 m/s, and the duet construction does not prevent the piston from splitting when the current gradient changes in the accelerator circuit. A transitional armature is examined which makes it possible to increase the initial speed to 1200 m/s. Indirect results indicate that initial speeds of up to 2000 m/s may be possible. After the formation of a plasma piston the piston remains stable with a positive current gradient in the accelerator circuit. If the current changes gradient sharply, the piston splits and its length increases dramatically. However, if the gradient changes in a metallic or microarc mode (the current passes through the rail/armature surface) the piston forms normally and remains compact even at a negative current gradient. When a transitional armature is used, the macroparticle is stably accelerated even when current decreases to 0.6 its maximum value. Figures 8; tables 2; references 3: 2 Russian, 1 Western.

Russia: Numerical and Experimental Study of Electromagnetic Acceleration of Macrobodies Using a Metal Armature

964D0752B Novosibirsk PRIKLADNAYA
MEKHANIKA I TEKHNICHESKAYA FIZIKA
in Russian No 1, Jan-Feb 96 pp 21-27

[Article by A. V. Plekhanov, A. N. Tereshchenko, D. V.
Khandryga, Lyubertsk Scientific Production Associ-
ation "Soyuz", Dzerzhinskiy, Moscow oblast; (manu-
script received 30 Dec 94); UDC 620.193.1:629.036.72]

[FBIS Summary] This paper uses the finite elements method to study one of the factors affecting friction in high-speed sliding contact, when the full force of normal pressure which compresses the armature of an electromagnetic macroparticle accelerator to the surface of the channel shaft of the accelerator. The force of friction is proportional to the force of normal pressure. By reducing this force one can decrease energy losses to friction and consequently increase the effectiveness of electromagnetic acceleration. The main numerical results are confirmed experimentally. Macrobodies are accelerated with a railgun with a metal armature. The material of the armature is not as important as the body construction. Analytical expressions have been obtained for the effect of deformation on railgun acceleration (a decrease) and friction (an increase). The example of a cylindrical armature moving in a round channel is examined. Factors affecting the normal pressure force are considered. Active and passive portions of the contact surface are examined. Active pressure is due to electromagnetic

forces, passive pressure is due to transverse deformation of the armature and channel due to inertia and tightening. The effect of friction on energy losses is examined. The equations which are developed make it possible to compare possible energy losses due to friction in electromagnetic acceleration of a current-conducting armatures with different constructions. Recommendations are formed to improve these constructions to reduce losses. Energy losses to friction can be reduced by introducing a wide ring-shaped groove into the passive part of the armature. The numerical model developed here can be used to calculate contact pressure. Comparative analysis of two cylindrical U-shaped armatures are presented. Figures 7; tables 3; references 3 (Western).

Russia: Regular and Anomalous Flow Modes of a Gas-Liquid Medium Through a Channel Constriction

964D0752C Novosibirsk PRIKLADNAYA MEKHANIKA I TEKHNICHESKAYA FIZIKA in Russian No 1, Jan-Feb 96 pp 73-81

[Article by V. Yu. Lyapiderskiy, Lavrentyev Institute of Hydrodynamics, Siberian Division, Novosibirsk; (manuscript received 11 Jan 95); UDC 532.529:533.6.2]

[FBIS Summary] This is a theoretical study using a channel approximation of a nonsteady-state wave picture in the vicinity of a local constriction of a channel for a barotropically compressed liquid with a nonconvex state equation. The structure of nonsteady-state waves propagating upstream from local channel constriction is studied. The minimum cross section of the channel is completely controlled by the incident flow beyond the obstruction. The supersonic flow and wave picture downstream can be found as the solution of a Cauchy problem. Steady-state flow in a channel of variable cross section for gas with a nonconvex state equation may contain several shock waves. The advantages of a nonsteady-state approach to the problem of wave structure in the vicinity of a local channel constriction is not only that anomalous flow modes are found, but also that analysis of possible wave configurations in the constriction is simplified when one can separate shock waves generated by the obstruction and shock waves caused by conditions downstream. A special class of isothermic Van der Waal gas motions is studied in the vicinity of the initial point and can also be used for arbitrary barotropic gas motions. The generation of anomalous flow modes in the vicinity of a constriction is a common feature of two-phase flow models in which there is no monotonic dependence of the rate of propagation of nonlinear perturbations on wave amplitude. Figures 5; references 12; 7 Russian, 5 Western.

Russia: Mathematical Modeling of a Film Chemical Reaction of the Condensed Phase of Metal Oxides with Heat-Shielding Materials

964D0752D Novosibirsk PRIKLADNAYA MEKHANIKA I TEKHNICHESKAYA FIZIKA in Russian No 1, Jan-Feb 96 pp 139-144

[Article by V. A. Burakov, Scientific Research Institute of Applied Mathematics and Mechanics, Tomsk; (manuscript received 10 Jun 94; 9 Jan 95); UDC 536.422]

[FBIS Summary] This paper presents a mathematical model of a film chemical reaction between carbon graphite heat-shielding materials and condensed-phase metal oxides precipitating inertially from a high-temperature two-phase flow of particles. The interaction of high-temperature two-phase flows with the carbon graphite heat shielding material of multi-component walls in the vicinity of the leading point of the flow over flat or blunt bodies is studied at low collision speeds and significant mass flux of the semidisperse liquid condensed-phase particles that are precipitating inertially. In intense combined heating of the carbon graphite surface a liquid condensed phase film forms which is chemically active and enters into a reduction reaction with carbon forming condensed and gaseous products. The condensed components wet the surface, and the gaseous components cool it through transpiration through the melt layer. The liquid film also is somewhat heat resistant and lessens the impact of other liquid particles. The thickness of the layer is dependent on competing effects. The thin reacting condensed phase layer is described by a laminar incompressible boundary layer of a two-phase one-temperature two-component "frozen in" gas-liquid medium. Other assumptions are listed. The most important hydrodynamic and thermophysical parameters of interaction can be found. Examples are presented. Figures 2; references 8 (Russian).

Russia: Experimental and Theoretical Studies of Heat Flows from a Supersonic Diffuser

964D0752E Novosibirsk PRIKLADNAYA MEKHANIKA I TEKHNICHESKAYA FIZIKA in Russian No 1, Jan-Feb 96 pp 158-164

[Article by V. N. Zaykovskiy, V. M. Trofimov, S. I. Shrekalkin, Institute of Theoretical and Applied Mechanics, Siberian Division, Russian Academy of Sciences, Novosibirsk; (manuscript received 28 Nov 94; 20 Feb 95); UDC 536.24:532.526]

[FBIS Summary] This paper presents experimental results of the study of heat flux and heat exchange in a supersonic diffuser and calculates the coefficients of heat exchange along the cylinder element on the inter-

nal surface. Heat exchange in the nonequilibrium turbulent boundary layer is modeled with nonequilibrium turbulence using a special function which considers the effect of the orientation of the main flux on large-scale turbulence. The structure the diffuser and the air flow system are described. The procedure used for measuring pressure and temperature fields is described. The velocity fields inside the diffuser are calculated with a Rayleigh formula linking total pressure before and after the shock wave. Experiments revealed a local separation zone with dimensions on the order of the thickness of the boundary layer. The distribution of local coefficients of intensity of heat exchange reflect flux properties deriving from the pressure distribution. Experimental results for diffusers with different diameters are described. The area of most intense heating is the region where streams flowing from the supersonic nozzle connect. The increased heat exchange as reflected shock waves interact downstream has no distinct peak regions, but a significant average level of heat exchange. A theoretical model of heat exchange along a surface with breaks in the cylinder element on the internal diffuser surface in a supersonic flow of gas agrees well with experimental data. Figures 5; references 11: 9 Russian, 2 Western.

Ukraine: Reconstruction of Doses of Radioactive Irradiation of α -Quartz Crystals from the Chernobyl Zone

964D0781A Minsk ZHURNAL PRIKLADNOY
SPEKTROSKOPII in Russian
No 1, Jan-Feb 96 pp 158-160

[Article by A. B. Brik, V. Ya. Degoda, Yu. A. Marazuyev, V. V. Radchuk, Taras Shevchenko Kiev University; (manuscript received 13 Dec 94); UDC 535.27-32]

[FBIS Summary] The equivalent doses of radioactive irradiation of α -quartz crystals were measured. The crystals were taken from brick structures in the accident zone of the Chernobyl atomic power plant. Three luminescence methods were used to reconstruct doses: standard pre-doses with 100°C peak thermally stimulated luminescence, high-temperature thermal luminescence, and X-ray luminescence. Electron paramagnetic resonance was also used. The procedures used in obtaining measurements for each method are described. Results obtained using different methods generally agree. The graph of the dependence of the intensity of signals on the dose of laboratory irradiation is presented as well as calibration curves. The following findings are presented (doses in gram-roentgens): city of Chernobyl, 0.6-0.9; Shepelichi, 3-4; Novaya Krasnitsa, 3.5-4.5; Tolstyy Les, 4-9; Yanov station, 17; construction administration of

atomic power plant, 10; garage of Jupiter factory, 17; Podlesnyy garages and farm, 31; pumping station of Chernobyl atomic power plant, 20. Figures 2; table 1; references 7: 5 Russian, 2 Western.

Belarus: Interdopant Radiative Recombination in p-Germanium Transmutationally Doped by Fast Neutrons

964D0781B Minsk ZHURNAL PRIKLADNOY
SPEKTROSKOPII in Russian
No 1, Jan-Feb 96 pp 167-171

[Article by V. P. Dobrego, O. P. Yermolayev, Belarus State University, Minsk; (manuscript received 22 Mar 95); UDC 621.315.592]

[FBIS Summary] The change in the electric activity of dopants (initial and transmutationally introduced) due to neutron irradiation and subsequent annealing is important in the study of transmutationally doped germanium. This method yields a much more uniform distribution of dopants than traditional metallurgical methods. p-type germanium samples were irradiated with fast reactor neutrons and annealed for 24 hours at 450°C. Their photoluminescence spectrum was studied at 4.2 K. After irradiation but before annealing the samples were not luminescent. After annealing luminescence lines (at 725 and 698 meV) were observed that are attributed to As-Ga interdopant transitions. It is thought that irradiation causes dopants to move to interstitial space and lose electric activity. Annealing restores the dopants to nodes and restores electric activity. The As-Ga transition lines agree well with experimental and theoretical data for germanium transmutationally doped with thermal neutrons. A weak broad line in the spectrum is attributed to radiation defects. Figure 1; references 8 (Russian).

Russia: DNM-1 Neutron Physics Measurement Complex

964D0790A Moscow PRIBORY I TEKHNIKA
EKSPERIMENTA in Russian
No 1, Jan-Feb 96 pp 20-24

[Article by V. I. Mikerov, I. N. Zhelezov, V. V. Konashenok, V. A. Tukarev, K.N. Zaytsev, V. N. Petrov, M. P. Yakovlev, Lebedev Physics Institute, Russian Academy of Sciences, Moscow; (manuscript received 31 Oct 94; after revision 26 Jun 95); UDC 539.1.078]

[FBIS Summary] The DNM-1 complex can be used for small-angle, reflectometric, radiographic, and tomographic studies, as well as powder diffractometry in the wavelength range of thermal and cold neutrons based on position-sensitive detectors of varying resolution. The complex features completely automated

operation. The neutron beam from the reactor at the Moscow Engineering-Physics Institute passes through a beam limiter, a two crystal monochromator, a collimation system, monitoring detector, ample table, two-coordinate position sensitive detector, diffractometer detector, and another two-coordinate position sensitive detector. Data collection and processing is done on personal computers. Experiments studied the dependence of flux on wavelength, the contribution to high harmonics to intensity and resolution (by wavelength) of beam neutrons incident on the sample. Several types of monochromator crystals were tested, including pressed graphite, pyrolytic graphite and other materials. Figures 4; references 12: 5 Russian, 7 Western.

Russia: Neutron Two-Crystal Monochromator

964D0790B Moscow PRIBORY I TEKHNIKA
EKSPERIMENTA in Russian
No 1, Jan-Feb 96 pp 25-29

[Article by V. I. Mikerov, V. I. Vedernikov, Ye. N. Soldatova, V. A. Tukarev, Lebedev Physics Institute, Russian Academy of Sciences, Moscow; (manuscript received 31 Oct 94; after revision 26 Jun 95); UDC 539.1.078]

[FBIS Summary] This monochromator is part of the DNM-1 neutron physics complex at the Moscow Engineering-Physics Institute. It is designed for small-angle, reflectometric, radiographic, and tomographic studies using thermal and cold neutrons. The monochromator has two crystals with a mechanical link between crystals to insure stable positioning of the output beam as wavelength changes without additional crystal adjustment. The mechanism used to position the crystals is described. Stepper motors are used to shift the position of the crystals. Wavelength is changed by altering the grazing angle between the direction of the neutron beam and the reflective planes of crystals. The two crystals are mounted on one base which is installed in a housing to provide a vacuum chamber if required. The monochromator was calibrated with measurements of neutron spectra using a time of flight method. Several types of crystals were tested to study the spectral characteristic of the monochromator. The maximum flux is provided by pyrolytic graphite, the best resolution is provided by germanium crystals. Figures 4; tables 3; references 11: 7 Russian, 4 Western.

Russia: Measurement and Computing Complex To Study Nuclear Reactions

964D0790C Moscow PRIBORY I TEKHNIKA
EKSPERIMENTA in Russian
No 1, Jan-Feb 96 pp 44-48

[Article by S. V. Artemov, I. R. Gulamov, I. Yu. Zotov, A. A. Karakhodzhaev, Institute of Nuclear Physics, Academy of Sciences of Uzbekistan, Tashkent; (manuscript received 16 Jun 94; after revision 23 Jan 95); UDC 539.107.5]

[FBIS Summary] This measurement and computing complex is based on an IBM PC AT and standard KAMAC equipment. The complex measures the angular distribution of differential cross sections of nuclear reactions with emission of charged particles in a wide range (2-178°) with errors no worse than seven percent. The complex uses analog and digital methods of identifying the sort of detected particles using partial (ΔE) and total (E) ionization losses. The design of the scattering chamber is described. Each of two independent remote controlled drives has four telescopes with ΔE and E detectors covering a range of scattering angles of 10-178° with an adjustment accuracy of about 20°. An additional telescope measures emission angles of 2-20°. The signal processing system is described. The processing software (PC-EDE) is written in C and Assembler with an overlay structure and can be used in an MS-DOS environment. Signal processing procedures are described. Experimental spectra of reaction products are presented. Figures 6; references 9: 6 Russian, 3 Western.

Russia: Some Extensions of Problem of Interaction Between Blunt Bodies and Nonuniform Supersonic Flows

964D0959A Moscow IZVESTIYA ROSSIYSKOY
AKADEMII NAUK: MEKHANIKA ZHDKOSTI I
GAZA in Russian No 2, Mar-Apr 96 pp 164-170

[Article by S. V. Guvernyuk, K. G. Savinov, Moscow; manuscript received 14 Feb 95; UDC 533.6.011.5]

[FBIS Summary] The authors study the properties of steady-state gas flows in a shock layer in the case of axisymmetric supersonic flow of a perfect gas with shear inhomogeneity of general type past blunt bodies. Classes of geometrically similar flows are determined for which a kinematic inhomogeneity can be reduced to thermodynamic, and vice versa. The limits of existence of a shock layer without secondary flows and self-oscillations are determined, based on the example of numerical parametric analysis of flow around a sphere. The work was done under the auspices of the Universities of Russia project. Figures 5, formulas 16, references 9.

Russia: Formulas for Thermal and Diffusion Flows to Catalytic Surface in Chemically Nonequilibrium Multicomponent Boundary Layer

964D0959B Moscow IZVESTIYA ROSSIYSKOY
AKADEMII NAUK: MEKHANIKA ZHIDKOSTI I
GAZA in Russian No 2, Mar-Apr 96 pp 171-176

[Article by V. L. Kovalev and O. N. Suslov,
Moscow; manuscript received 21 Feb 95; UDC
533.6.011.5:532.526:541.12]

[FBIS Summary] Based on asymptotic expansion of the solution of equations of a multicomponent chemically nonequilibrium boundary layer at large Schmidt num-

bers, formulas are given for heat flow, and for diffusion flows of reaction products and chemical elements to a surface with arbitrary catalytic activity. Comparison of the results with known analytical and numerical solutions shows that the proposed formulas have high accuracy. The paper gives the results of calculations of diffusion separation of a mixture due to selectivity of surface catalytic properties relative to recombination of oxygen and nitrogen atoms. The amounts of reduction of convective heat fluxes due to catalytic surface properties are determined for a wide range of conditions in the incident flow. Figures 5, formulas 8, references 16.

Ukraine: High-Temperature Electrochemical Synthesis of Tungsten Carbide in Chloride-Metaphosphate Melts Under Excess Carbon Dioxide Pressure

964D0802A Kiev ZHURNAL NEORGANICHESKOY KHMII in Russian Sep 95
Vol 40 No 9, pp 1438-1443

[Article by I.A. Novoselova, V.V. Malyshev, A.Ye. Pinadorin, and V.I. Shapoval, General and Inorganic Chemistry Institute imeni V.I. Vernadskiy, Ukrainian National Academy of Sciences, Kiev; manuscript received 9 Dec 94; UDC 541.131:546.261]

[FBIS Summary] The possibility of high-temperature electrochemical synthesis of tungsten carbide in chloride-metaphosphate melts under excess carbon dioxide pressure was examined in experiments based on two electrochemical methods: voltammetry and potentiometry. The effect of PO_4^{3-} metaphosphate ions on the electrochemical behavior of W(VI) oxy anions was studied at 1,023 K in the following systems: (1) $\text{PuKCl-NaCl-Na}_2\text{WO}_4\text{-NaPO}_3\text{IKCl-NaCl-2.5}$ molecular percent PbCl_2IPb ; (2) $\text{WIKCl-NaCl-Na}_2\text{WO}_4\text{-NaPO}_3\text{IKCl-NaCl-2.5}$ molecular percent PbCl_2IPb ; and (3) $\text{PuKCl-NaCl-Na}_2\text{WO}_4\text{-NaPO}_3\text{-CO}_2\text{IPb}$. The first two systems were studied by voltammetry in semisubmerged electrodes in reagent-filled cells and with instruments described elsewhere. The electromotive force of the two systems was measured by high-ohm voltammetry. Sodium ditungstenate was obtained by melting (at a temperature of 1,173 K) the oxide and oxy salt in an equimolar ratio. The study results were verified by roentgenography. System 3 was studied by potentiometry. The experiments confirmed the possibility of using multielectrode processes to reduce tungsten from dimeric forms in a narrow range of potentials, as well as the possibility of using the acid-base properties of the melt to control the process potential. The conditions of convergence of the potentials of the reduction of carbon dioxide and dimeric forms of tungsten were found. Specifically, during combined electrolytic reduction of CO_2 and $\text{W}_2\text{O}_7^{2-}$ in a chloride melt that has been acidified with the anion PO_4^{3-} , the discharge potential of the CO_2 is nearly 300 mV more positive than the discharge potential of the $\text{W}_2\text{O}_7^{2-}$. Consequently, when the gage pressure of the carbon dioxide in the cell is low, combined electrolytic reduction of CO_2 and $\text{W}_2\text{O}_7^{2-}$ is not possible inasmuch as the tungsten is reduced on the carbon that has already been deposited at the cathode. As the gage pressure of the carbon dioxide is increased, the $\text{W}_2\text{O}_7^{2-}$ wave shifts to the region of more positive potentials, and at a pressure of 17×10^5 Pa, the waves of the electrolytic reduction of CO_2 and $\text{W}_2\text{O}_7^{2-}$ merge into a single stretched wave.

The fundamental possibility of direct electrochemical synthesis of tungsten carbide under excess carbon dioxide pressure was confirmed in a series of experiments in which the cathode current density during the electrolysis period was varied from 5 to 30×10^2 A/m². A single-phase WC product was obtained at levels of $p_{\text{CO}_2} \geq 17 \times 10^5$ Pa. The following electrolyte composition was determined to be optimum (molecular percent): NaCl, 47.25-55.0; KCl, 47.25-55.0; Na_2WO_4 , 5.0-10.0; and NaPO_3 , 0.5-2.0. Transmission electron microscopy established that the WC was characterized by two types of particles: layered, weakly coupled conglomerates (ranging from 10 to 20 μm in size) and individual acicular crystals (ranging from 0.5 to 1 μm in size). The specific surface of the WC powders ranged from 10 to 25 m²/g. The ratio of W and bound C in the electrochemical synthesis product was confirmed to correspond to that of the stoichiometric compound WC. Figures 5, table 1; references 20: 13 Russian, 7 Western.

Russia: Diagramma Data Bank of Phase Diagrams of Semiconductor Systems

964D0877A Moscow NEORGANICHESKIYE MATERIALY in Russian Sep 95
Vol 31 No 9, pp 1198-1203

[Article by V.S. Zemskov, N.N. Kiseleva, N.N. Kiselev, V.V. Petukhov, Ye.A. Cheremushkin, L.Ye. Shelimova, N.V. Kravchenko, and I.N. Belokurova, Metallurgy Institute imeni A.A. Baykov, Russian Academy of Sciences, Moscow; manuscript received 7 Jun 94; UDC 541.123.2+541.123.3:621.315.592:681.142]

[FBIS Summary] The Institute for Chemical Problems in Microelectronics of the Russian Federation Ministry of Science and Technology Policy and the Metallurgy Institute imeni A.A. Baykov of the Russian Academy of Sciences have undertaken a collaborative project to create a data bank called Diagramma. The Diagramma data bank will contain phase diagrams of semiconductor systems and all the information that specialists generally use when examining phase equilibrium in systems. Initially, the data bank will contain phase diagrams of two- and three-component systems. More complex systems will be added as work on the data bank proceeds. The following types of information will be available in the data bank: tables of experimental data regarding lines of multivariant, monovariant, and nonvariant equilibrium that have been taken from various publications and evaluated by experts, as well as data regarding singular points; tables of data on the aforesaid equilibrium lines and singular points obtained through statistical processing or thermodynamic reconciliation of experimental data by experts; and phase diagrams of

systems that have been drawn in accordance with accepted world practice, which is to say in the form of drawings based on data obtained by expert estimates, statistical processing, or thermodynamic reconciliation of experimental data. Because a significant portion of systems with semiconductor phases include chemical elements having a high degree of vapor elasticity at temperatures above room temperature and may therefore be considered condensed, such systems are represented by using T - x , p - T , and p - x projections of p - T - x diagrams for two-component systems and T - x - y , p - T - x , p - T - y , and p - x - y projections of p - T - x - y diagrams for three-component systems. The data bank will also include analytic reviews written by experts. These reviews will evaluate the phase diagrams presented and include additional information on systems that is not included in the relational tables. The data bank will not be limited to semiconductor compounds of a single group. Systems containing various types of semiconductor compounds of practical importance will be included. The following types of systems have been selected for inclusion in the Diagramma data bank in the initial phase of its development: systems based on Si and Ge; $A^{\text{IV}}B^{\text{IV}}$, $A^{\text{IV}}B^{\text{VI}}$, $A^{\text{IV}}B^{\text{V}}$, and $A^{\text{IV}}B^{\text{VI}}$ systems; systems containing a chalcogen and group I, III, or V element; three-component systems containing $A^{\text{IV}}B^{\text{IV}}$, $A^{\text{IV}}B^{\text{V}}$, $A^{\text{IV}}B^{\text{VI}}$, and $A^{\text{IV}}B^{\text{VI}}$ solid solutions; three-component systems containing ternary semiconducting compounds; and systems consisting of a semiconducting compound and dopant. Besides containing databases of information about binary and ternary systems, the Diagramma data bank will also include a database of information about the references cited in the other databases. All three databases will be relational databases. It will be possible to use a scanner to input graphs or drawings into the data bank. The drawings will be stored outside the databases and will be called up at the user's request. The data bank already contains information about several dozen semiconductor systems. The data bank is based on the DATAREAL database manager, which operates in an environment of MS DOS 5.0 or higher. The Diagramma data bank may be used on an IBM PC/AT or PS/2 with a VGA monitor and Epson LQ (or FX) or Proprinter XL24 printers. Figures 3; references 17 (Russian).

Russia: New Compounds in the System MoO_3 - V_2O_5 , 964D0877B Moscow NEORGANICHESKIYE MATERIALY in Russian Sep 95
Vol 31 No 9, pp 1225-1229

[Article by V.V. Molchanov, L.M. Plyasova, V.V. Goydin, O.B. Lapina, and V.I. Zaykovskiy, Catalysis Institute, Siberian Department, Russian Academy of

Sciences, Novosibirsk; manuscript received 20 Jun 94; UDC 541.12.03:546.5-546.776]

[FBIS Summary] Vanadium-molybdenum compounds are widely used as catalysts of selective oxidation of organic compounds. Various compounds in the system MoO_3 - V_2O_5 have been described that are produced by heating a mixture of oxides or ammonium salts of molybdenum and vanadium. The high temperatures required for such processes necessitate the expenditure of large amounts of energy and also result in the release of toxic vanadium oxide vapors. A series of experiments were therefore conducted to synthesize new compounds in the system MoO_3 - V_2O_5 by a mechanochemical method. The mechanical activation was performed in an AGO-2 water-cooled planetary centrifuge mill with a drum rotation speed of 10 rotations per second. The balls had a diameter of 4 mm and weighed 0.2 kg each. The activation mixture weighed 5 g. The vanadium oxide and molybdenum oxide used to synthesize the compounds were both graded chemically pure. A Bruker MSL-400 spectrometer, URD-63 diffractometer, and JEM-100 CX microscope were used to study the new compounds. The experiments confirmed the possibility of mechanochemical synthesis of oxide compounds of molybdenum and vanadium. Specifically, the experiments confirmed that mechanochemical activation of a mixture of V_2O_5 and $n\text{MoO}_3$ results in a bulk reaction of the molybdenum and vanadium oxides that in turn lead to the formation of structures based on MoO_3 when n is between 2 and 22 or based on V_2MoO_4 when $n = 1$. The newly synthesized compounds described by the general formula $\text{V}_2\text{O}_5 \cdot n\text{MoO}_3$ ($n = 2$ to 22) all have a crystalline structure based on orthorhombic MoO_3 in which layers of molybdenum oxide alternate with layers of vanadium oxide. The compound synthesized when $n = 1$ belongs to the group of nonstoichiometric compounds of the V_2O_5 structural type that have been described in the literature. The mechanism of the formation of compounds in the system MoO_3 - V_2O_5 in a no-waste mechanochemical activation-based process not requiring high temperatures was concluded to be based primarily on breaking of the bonds in the starting vanadium and molybdenum oxides along their cleavage planes (in the direction 040) but to also involve the breakdown of the compound's layers through separation of the individual chains of polyhedra. It was further concluded that the said process results in partial conversion to an amorphous state and that because the chains cannot exist in isolation on account of their coordination unsaturation, they adhere to the surface of larger particles and thus become part of round agglomerates. It was hypothesized that the oxygen binding the chains of tetrahedra in the layers fractured in the di-

rection 060 may also be removed. Figures 3, table 1; references 12: 7 Russian, 5 Western.

Russia: Crystalline Structure of LaCaGaO₃ and NdSrGaO₃

964D0877C Moscow NEORGANICHESKIYE MATERIALY in Russian Sep 95
Vol 31 No 9, pp 1234-1237

[Article by L.O. Vasilechko, A.A. Fedorchuk, D.I. Savitskiy, A.O. Matkovskiy, and S.B. Ubizskiy, Lvov Scientific Research Institute for Materials and Karat Scientific Production Association; manuscript received 17 Jan 95; UDC 548.4]

[FBIS Summary] Layered oxides with the composition ABXO₃ (where A designates a rare earth metal, B designates Ca or Sr, and X designates Al or Ga) and with a layered perovskite-like structure are used as substrate materials for high-temperature superconductor films and as matrices for luminophor and laser materials. In view of the importance of such materials, the crystalline structures of the compounds LaCaGaO₃ and NdSrGaO₃ were examined in an x-ray crystallographic analysis. The study samples were prepared from the oxides Nd₂O₃, La₂O₃, and Ga₂O₃ and the carbonates CaCO₃ and SrCO₃. The pressed starting mixtures were roasted in air at 1,370 K for 40 hours. The resultant materials were not single-phase compounds. According to an x-ray phase analysis performed with a DRON-3.0 diffractometer with CuK_α radiation, the phases LaCaGaO₃ and NdSrGaO₃ were present in the roasted study samples in concentrations not exceeding 20 and 90 percent, respectively. To obtain single-phase study samples suitable for structural analysis, the sintered starting mixtures were first refined in an electric arc furnace in an atmosphere of purified argon. The resultant complex oxides were determined to be crystallized in the structural type K₂NiF₆ (limiting boundary, 14/100mm). The positional and thermal parameters of the ions in the two crystal structures examined were refined based on the intensities of the reflexes of their powder diffractograms. The two crystal structures were also subjected to a crystalline chemistry analysis. The values of the periods of the study samples' elementary cells were calculated by the least squares method based on 30 reflexes from the powder diffractograms. The results obtained for LaCaGaO₃ were as follows: $a = 3.8160(2)$ and $c = 12.343(1)$ angstroms. The results obtained for NdSrGaO₃ were as follows: $a = 3.8151(2)$ and $c = 12.523(1)$ angstroms. The following were among the crystallographic data determined for LaCaGaO₃: volume, 179.74(3) cubic angstroms; number of atoms per cell, 14.0; density (calculated), 5.778(1) g/cm³; absorption factor, 1.096.20V cm; λ_{Cu} 1.54178 angstroms; number of free parameters,

8; $2\theta_{\text{max}}$ 133.87 degrees; R_p 0.0696; and axis and texture coefficient, [011] 0.86(7). The following were among the crystallographic data determined for NdSrGaO₃: volume, 182.27(3) cubic angstroms; number of atoms per cell, 14.0; density (calculated), 6.660(1) g/cm³; absorption factor, 1.282.03/cm; λ_{Cu} 1.54178 angstroms; number of free parameters, 8; $2\theta_{\text{max}}$ 107.85 degrees; R_p 0.0499; and axis and texture coefficient, [110] 1.9(1). Figures 3, tables 3; references 8: 1 Russian, 7 Western.

Russia: Properties of Cd-Doped ZnSe Single Crystal Layers

964D0878A Moscow NEORGANICHESKIYE MATERIALY in Russian Oct 95
Vol 31 No 10, pp 1299-1301

[Article by M.M. Berezovskiy and V.P. Makhmry, Chernovitsy State University imeni Yu. Fedkovich; UDC 535.37]

[FBIS Summary] The optical and radiative properties of ZnSe<Cd> layers were examined in a series of experiments performed on zinc selenide single crystals grown from a melt under pressure. Some of the crystals were left undoped, while others were doped with aluminum or tellurium during the growth process. The isovalent dopant was added by subjecting the starting substrates to isothermal roasting in cadmium vapors at temperatures of 500-800°C for 0.5 hours. Doping the zinc selenide crystals with cadmium was found to affect their optical transmission [T_{e}], with the shape of the curve plotted for T_{e} depending largely on the composition of the starting material. The curves plotted for the dependence of T_{e} on photon energy contained a distinct "arm" in the case of substrates containing Te or Al; this was attributed to the fact that heat treatment causes the cadmium atoms to replace zinc atoms in the ZnSe in a diffusion-type process and to the fact that a new compound, i.e., CdSe, may form in the near-surface layer under certain conditions. Formation of CdSe was confirmed by the sharp decrease in the curve plotted for T_{e} in the vicinity of photon energies of 2 eV, which is near the width of the forbidden band of the cubic modification of CdSe. As the film's thickness increased (beginning at a thickness of about 1 μm), the high-energy photons were practically completely absorbed in the CdSe and the "arm" was no longer present in the transmission spectrum. Doping zinc sulfide crystals with an isovalent cadmium dopant was found to result in the flare-up of a green-light blue band in their layer spectra at 300 K. The cadmium-doped crystals were determined to possess good n-type conductivity ($\sigma_{\text{n}} > 1$ siemens per centimeter [S/cm]) and were recommended for use in manufacturing light-emitting diodes emitting light in the short-wave range. Figures 3; references 10 (Russian).

Ukraine: Photoelectric Properties of Polycrystalline Cd_{0.8}Hg_{0.2} Layers on Sapphire

964D0878B Moscow NEORGANICHESKIYE MATERIALY in Russian Oct 95
Vol 31 No 10, pp 1335-1337

[Article by A.I. Vlasenko, V.A. Gnatyuk, Ye.P. Kopeshinskaya, V.I. Lukyanenko, P.Ye. Mozol, and A.V. Sukach, Semiconductor Physics Institute, Ukrainian National Academy of Sciences, Kiev; UDC 546.49'48'242]

[FBIS Summary] A study examined the photoelectric properties of polycrystalline Cd_{0.8}Hg_{0.2} layers on sapphire. The study samples of Cd_{0.8}Hg_{0.2} ($x = 0.28$) were grown by the vaporization-condensation-diffusion method under isothermal conditions (773 K) on CdTe/Al₂O₃ structures. First, a layer of CdTe that was approximately 3 μm thick was sprayed onto the substrate. The Cd_{0.8}Hg_{0.2} layer that was subsequently grown was approximately 20 μm thick. The polycrystal had an average grain size of 30 μm . According to Hall measurements, the resultant structures had n-type conductivity, an effective charge carrier concentration at 80 K of 3 to 7 $\times 10^{19}/\text{cm}^3$, and an effective charge carrier mobility at 80 K of approximately 1-3 $\times 10^4$ $\text{cm}^2/\text{V}\cdot\text{s}$. The study samples' spectral distribution of photoconductivity and lux-ampere characteristics were measured as the study samples were illuminated from the side of the Cd_{0.8}Hg_{0.2} layers and from the side of the sapphire substrate at temperatures of 77 and 300 K. The study samples' lux-ampere characteristics were measured as the samples were excited by pulses of a neodymium laser operating at a wavelength of 1.06 μm (pulse duration, 20 ns). The lifetime of the nonequilibrium charge carriers was estimated by the curves of the relaxation of the photoconductivity signal, which was exponential. Indium contacts were placed on a mirror-smooth surface of polycrystalline Cd_{0.8}Hg_{0.2}. A comparison of the photoelectric properties of the Cd_{0.8}Hg_{0.2} layers measured as the study samples were illuminated from the surface and from their upper surface and from the side of their substrate indicated that their structure was more perfect in the vicinity of the substrate than in the vicinity of their surface. The behavior of the layers' lux-ampere characteristic also changed depending on the direction from which they were illuminated. The said changes were concluded to be characteristic of an Auger recombination mechanism. The differences in the nature of the dependence of the photoconductivity signal on intensity of the laser radiation that were observed when the study samples were irradiated from the side of the Cd_{0.8}Hg_{0.2} layer and from the side of the sapphire substrate were attributed to a change of recombination channel. The polycrystalline layers of Cd_{0.8}Hg_{0.2} on sapphire were de-

termined to have a photosensitivity of 2 to 5 μm at 300 K, which from an order-of-magnitude standpoint is analogous to the photosensitivity of structurally perfect Cd_{0.8}Hg_{0.2}Te crystals and CdHgTe/CdTe epitaxial layers. It was hoped that given refinements in the process of producing the Cd_{0.8}Hg_{0.2} layers on sapphire, it would be possible to produce specimens having characteristics with a sufficient degree of reproducibility to warrant recommending them for use in infrared radiation detectors intended for operation at room temperatures. Figures 3; references 5: 3 Russian, 2 Western.

Russia: Luminescence of ZnS:Tb³⁺ and ZnS:Sm³⁺ Films Produced by the Decomposition of Chelate Complexes

964D0879A Moscow NEORGANICHESKIYE MATERIALY in Russian Mar 96
Vol 32 No 3, pp 285-290

[Article by A.N. Georgobianin, V.I. Demin, and Ye.S. Leishchinskaya, Physics Institute imeni P.N. Lebedev, Russian Academy of Sciences, Moscow, and L.I. Matyna and S.P. Oleynik, Moscow Institute of Electronics Technology; manuscript received 23 Feb 95; UDC 539.216.2:546.47'221]

[FBIS Summary] A study examined the photoluminescence and cathodoluminescence of zinc sulfide films (ZnS:Tb³⁺ and ZnS:Sm³⁺) produced by a low-temperature method of breaking down sulfur-containing chelate complexes that are activated by terbium and samarium during the deposition process. The synthesis method is unique in that both components of the final compound are a part of the molecule of the starting reagent, thus forming a chelate cycle. An added benefit of the synthesis method is that it is less toxic than the widely used metal-organic chemical vapor deposition (MOCVD) method. The films were deposited onto a pyroceram substrate at 410°C in a neutral atmosphere (in a nitrogen flow). Activated films were obtained by adding different concentrations of heteroligand coordination compounds of terbium and samarium (i.e., ML₂L'-type compounds, where M is a rare earth metal and L and L' are ligands) to the starting solution of zinc diethyldithiocarbamate in dimethylformamide. The resultant polycrystalline ZnS films were 0.5 μm , and their grain size ranged from 0.2 to 0.25 μm . Photoluminescence was excited by using a pulse nitrogen laser with a wavelength of 337 nm, pulse duration of 10 ns, and frequency of 100 Hz. The excitation density amounted to approximately 0.2 MW/cm². Cathodoluminescence was excited by an electron beam with an energy of 10 keV and a current density of 10⁻⁴ A/cm². The spectra were recorded at room temperature. Rutherford backscattering was used

to determine the level of rare earth activators in the films. The films were subjected to heat treatment in the same neutral atmosphere by heating them in zinc sulfide powder at temperatures of 410, 550, 650, and 750°C for 30 minutes and 1 hour. Studies conducted on specially doped films established the presence of three absorption bands in the cathodoluminescence spectra of the nonannealed films, i.e., at 445, 570, and 650 nm. The photoluminescence spectra were in the form of a bell-shaped band with a peak at 600 nm. Annealing at 410°C for either 30 minutes or 1 hour did not induce any significant changes in the films' photoluminescence or cathodoluminescence spectra. When the films were annealed at 550°C, however, the integral intensity of their photoluminescence and cathodoluminescence increased by more than an order of magnitude. Annealing at 650°C resulted in only a slight increase in intensity of the photoluminescence and cathodoluminescence bands. A study of the effect of dopant concentration and annealing temperature established the presence of narrow bands of intracenter luminescence of the terbium and samarium ions corresponding to the radiative transition $^3D_4 \rightarrow ^7F_j$ ($j = 3, 4, 5, 6$) in the Tb^{3+} ion and to the radiative transition $^6G_{7/2} \rightarrow ^4H_j$ ($j = 5/2, 7/2, 9/2$) in the Sm^{3+} ion. The most intense bands were the band at 546 nm in the $ZnS:Tb^{3+}$ films and at 655 nm in the $ZnS:Sm^{3+}$ films. The intensity of the intracenter bands increased monotonically as the concentration of rare earth dopant increased all the way to 0.2 atomic percent in the case of Tb^{3+} and 2 atomic percent in the case of Sm^{3+} . The possibility of optimizing the key parameters of luminescence by annealing was confirmed. Figures 4; references 3 (Russian).

Russia: Production of Polycrystalline SnO_2 and $SnO_2<CuO>$ Films by the Laser Ablation Method

964D08798 Moscow NEORGANICHESKIYE MATERIALY in Russian Mar 96
Vol 32 No 3, pp 326-332

[Article by N.V. Morozova, A.M. Gaskov, T.A. Kuznetsova, F.N. Putlin, M.N. Romyantseva, and V.I. Shtanov, Moscow State University imeni M.V. Lomonosov; manuscript received 19 Jan 96; UDC 539.216.2]

[FBIS Summary] A study examined the possibility of producing films of pure and copper oxide-doped tin dioxide films by the method of laser ablation of the respective metals and alloys followed by oxidation. Laser ablation of the tin and copper-tin alloys was performed in a vacuum of 10^{-3} Pa by using an excimer KrF laser with a wavelength of 248 nm and pulse duration of 20 ns. The laser radiation was focused on the target's surface at a 45° angle. The power-flow density of the laser radiation

ranged from 10^6 to 10^9 W/cm². The distance between the target and substrate did not exceed 4 cm. The optimum conditions for applying and oxidizing the films were found. The composition of the metal and oxidized films was studied by Auger electron spectroscopy and atomic emission spectrometry with inductively coupled plasma. The crystalline structure of the oxidized films was studied by x-ray diffraction, and the parameters of the polycrystalline films' actual microstructure were determined by scanning electron microscopy, x-ray diffraction, and high-temperature optical microscopy. The parameters of the films' microstructure were found to depend on both the power-flow density of the laser and the temperature to which the substrate was heated. The films with the most uniform grain sizes were produced when the substrate was heated to temperatures lying within one of two temperature intervals, i.e., 50-70°C and 280-300°C. Adding copper oxide to the tin dioxide films did not affect their real structure; however, enrichment of the near-surface layer with copper was observed under conditions of lengthy oxidizing roasting. Figures 7, tables 3; references 14 (Western).

Russia: An Opticoabsorption Method of Testing Components of a Gaseous Medium

964D0745A Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian
No 5-6, May-Jun 95 pp 291-293

[Article by Ye.B. Popova and I.V. Korshlev, Moscow State Academy of Chemical Machinebuilding, UDC 543.272.08]

[FBIS Summary] In view of the ever-increasing need to monitor industrial wastes and reduce environmental pollution, a new opticoabsorption method has been proposed for analyzing the components of a gaseous mixture. One of the most promising methods for monitoring waste gases is based on the principle of the ability of materials to selectively absorb radiation. Specifically, the Bouguer-Lambert-Beer law is used to link the intensity of the radiant flux incident upon $[J_0]$ and passing through $[J]$ an absorbent gaseous medium. Many different gas analyzer designs are based on the aforesaid principle and law. Modulation principles of measuring the informative signals are generally used because they permit more efficient separation of the legitimate signal from the noise and thereby result in instruments that are much more sensitive and precise. Gas analyzers are classified into one of two groups depending on the type of modulation on which they are based: modulation of the noninformative parameter and modulation of the informative parameter (self-reactance modulation). Gas analyzers with modulation of the radiant flux belong to the first group. Modulation of radiant flux may

be accomplished in several different ways. Interruption of the flux by a nonselective shutter is most commonly used, or by a shutter that selectively admits radiation in a specified range of wavelengths. Direct modulation of fluxes is possible by altering the supply voltage or current of the radiation source. One drawback of commercial gas analysis systems with modulation of the noninformative parameter is the complexity of keeping such systems stably adjusted while they operate continuously. Because of the limited possibilities of adjusting commercial gas analyzers with modulation of the non-informative parameter, it does not appear that the stability of such systems will be greatly improved any time soon. One way of improving the stability of the readings of opticoabsorption analyzers near the zero point that is possible is modulation of the informative parameter optical density [D], and one possible way of modulating D is by periodically altering the length of the trough along the path of the radiant flux. Several versions of an instrument based on that principle have been proposed. All have had some shortcoming. Other methods of modulation of the informative parameter are to use the effect of shifting the wavelength of peak transmission of an interference filter from the angle of incidence of the radiant flux onto its surface and periodically altering the pressure of the analysis gas in the working cell. Work is now under way to develop a gas analyzer in which modulation is accomplished by using a pneumatic generator to alter the pressure in the working cell. It consists of two three-membrane-type relays. One acts as a master pulse generator that switches on a vacuum pump and pumps the analysis gas from the working cell, whereas the other cuts off the flow of gas entering the gas analyzer's cell. The pressure in the instrument's working chamber may thus be regulated with a modulation frequency ranging from 2 to 5 Hz. Tests of a prototype of the said instrument have confirmed that it can significantly improve the stability of the readings of an opticoabsorption gas analyzer and reduce its detection limit accordingly. References 5 (Russian).

Russia: Information-Retrieval System for Obtaining Information About the Financing of Scientific Research Projects at Chemical and Petrochemical Industry Enterprises

964D0745B Moscow KHIMICHESKAYA
PROMYSHLENNOST in Russian
No 5-6, May-Jun 95 pp 303-307

[Article by Ye.A. Ryabenko, I.I. Kulikov, A.M. Bessarabov, A.V. Trefilov, V.V. Avseyev, and G.I. Rodina, Russian Federation Committee on the Chemical and Petrochemical Industry and State Chemical

Reagents and Ultrapure Materials Scientific Research Institute; UDC 66:65.011.46:339.13]

[FBIS Summary] One of the first tasks that must be accomplished before a computerized information-retrieval system for obtaining information about the financial support being provided to scientific research projects at enterprises in the chemical and petrochemical industries can be created is that of creating a system of databases reflecting the structure of the organizations and enterprises under the jurisdiction of the Russian Federation Committee on the Chemical and Petrochemical Industry. One way of accomplishing that task is through a system of 10 databases titled as follows: subsectors (each subsector's code, name, number of enterprises, amount of funds remaining from the previous year, and associations); plants (each plant's subsector, code, name, association, yearly plan, and agreed-upon percentage of funding); institutes (each institute's subsector, code, name, and total sum of the agreements it has concluded); uses (institute code, date, sum, comments); revenues (plant code, date, sum, comments); expenses (subsector code, date, sum, comments [purpose of expense]); contracts (institute code, contract code, contract text, direction of financing, contract amount, starting and ending dates, and remuneration of outside organizations); schedules (institute code, contract code, code of schedule point, stage number, cost, name, note indicating completion, note indicating remuneration, glossaries (glossaries titled "Directions of Financial Support" and "Project Themes"); and remuneration of stages (institute code, contract code, code of stage of plan, remuneration date, total). The system of databases has a hierarchical structure based on the "one-to-many" principle. The program interface is designed to make the system as convenient to use as possible. Whenever possible, a menu-based interface and the "point-and-select" principle are used. The main screen is divided into three sections (containing a list of institutes, a list of contracts, and a series of control fields and buttons that make it possible to add/delete institutes and contracts, select contracts by execution date and type of financing (budgetary, extrabudgetary), distribute the committee's funds, prepare and print forms, change the system settings of a program, edit the glossaries, and work with the database files. The system allows users to distribute committee funds by individual agreements with institutes, by individual institutes, or within the framework of the entire sum of the committee's funds. In the latter case, all that is required is to enter a total sum. An algorithm is then used to distribute that sum by institute contracts. According to that algorithm, funds are distributed by the stages of contracts for the current quarter in proportion to the unpaid balance. The program has been developed on the basis of the FoxPro 2.5 database manager and

ForGraph graphics package, and it is designed for use on IBM PC/AT-type personal computers. Figures 3; references 6 (Russian).

Russia: Oligotrimethylsiloxyloxanes—the Foundation of a New Generation of Composites

964D0746A Moscow KHIMICHESKAYA
PROMYSHLENNOST in Russian Nov 95
No 11, pp 683-685

[Article by B.V. Molchanov, Ye.A. Chuprova, and S.V. Vinogradov; UDC 546.287]

[FBIS Summary] Oligotrimethylsiloxyloxanes are a new class of organosilicon compounds that are distinguished by the specific structure of their molecules, the main chains of which contain an $\text{SiO}_{1.5}$ unit housing $(\text{CH}_3)_2\text{SiO}_{1.5}$ [M] units. Trimethylsiloxyloxanes may be classified as trimethylsilyl derivatives of silicic acids. In the foreign literature, such compounds are called QM-siloxanes. The main methods of obtaining QM-siloxanes are hydrolytic and heterofunctional polycondensation of organosilicon monomers and trimethylsilylation of silicic acids and silicates. Studies of the physicochemical properties of the said class of compounds have focused mainly on those consisting of Q and M structural units, which can be combined in different ratios to form all sorts of compounds. QM-siloxanes are characterized by higher levels of thermal and thermooxidative stability than dimethylsiloxanes are. Studies have demonstrated that it is in principle possible to improve the quality of series-produced organosilicon products and simultaneously expand the range of temperatures at which they can be used by modifying them with oligoorganosiloxanes containing structural fragments of silicon dioxide. Optimum formulas and methods of producing a number of QM-siloxanes have been developed, and a pilot-commercial process for producing them has been tested. A number of composites have been developed on the basis of QM-siloxanes and put on the market. In the category of heat-insulating materials, for example, rubber fabric material has been created with a heat-insulating value and mechanical strength that are respectively 34 and 5 percent higher than existing materials intended for similar purposes. Another heat-insulating material that is based on QM-oligomers has a density of only 0.2 kg/cm³ and loses only 13-14 percent of its mass in high-temperature flows (the respective indicators of the available series-produced materials intended for the same purpose are 0.6 kg/cm³ and 38 percent). In the category of ceramic composites, a ceramic in which QM-siloxane (5 percent) has been used as a binder has been developed that has the physicochemical characteristics of aluminum oxide ceramic but is 1.5-2.0 times stronger than currently available aluminum oxide ce-

ramic intermediate products. New QM-oligomer-based heat-resistant enamel coatings have been developed that may be used at temperatures from -60 to 800°C and that are resistant to water, tropical conditions, and the effects of corrosive fuel components. In addition, they have good electrical insulation characteristics and adhere well to many materials (including copper, nickel, ceramic, and stainless steel). A new oligomer containing Q and M units has been developed and used as a binder for a high-temperature cold-drying glue that may be used to adhere components and thermal insulation to spacecraft operating at a temperature of 500°C and carbon dioxide pressure of 100 atm. A new QM-oligomer-based anti-adhesion material has also been developed that may be used to produce molds used in the process of manufacturing polyurethane products (including for footwear). QM-oligomers have also been used as the basis for developing new elastic compounds and water repellants. Studies have, for example, confirmed that adding QM-oligomers to water repellants used in concrete sharply boosts the strength of that concrete and reduces the adherence of ice to it. References 3 (Russian).

Russia: Research on the Polycondensation Vulcanization of Low-Molecular Weight Siloxane Rubbers and Their Actualization

964D0746B Moscow KHIMICHESKAYA
PROMYSHLENNOST in Russian Nov 95
No 11, pp 686-690

[Article by V.V. Severnyy; UDC 678.028.1/4]

[FBIS Summary] The processes occurring during the polycondensation vulcanization of one- and two-component composites based on low-molecular weight ($n = 500-2,500$) rubbers representing linear α,ω -dihydroxypolydiorganosiloxanes described by the general formula $\text{HO}(\text{SiR}_2\text{O})_n\text{H}$ were examined in depth. The one-component composites considered contained a low-molecular weight siloxane rubber and cross-linking agent. Besides containing rubber and a cross-linking agent, the two-component composites examined also contained a catalyst. First, the available literature on the topic was reviewed. It was concluded that none of the proposed mechanisms of vulcanization of low-molecular weight rubber in one- and two-component systems is consistent with the results of actual experiments. New mechanisms were therefore proposed that were said to be completely adequate with respect to the existing data obtained by various physicochemical methods and also with respect to theoretical analyses performed on the basis of the fundamental equations of Flory's theory of three-dimensional polycondensation. The first stage of the process of vulcanization of one-component composites was said to begin immediately

after the rubber and cross-linking agent are mixed and end with complete depletion of the SiOH groups in the starting system. Because one-component systems can in principle only exist at cross-linking agent:rubber ratios greater than 4:3 and because the said ratio is greater than 2 in real composites, a secondary system forms that includes an excess of cross-linking agent and one type of functional group (SiX). When stored in a leaktight container, the said system will be maintained for long periods. When the system is exposed to the moisture in air, however, the SiX bonds are hydrolyzed and SiOH groups form that react with the excess SiX groups, thereby resulting in a decrease in the X:OH ratio established in the primary system. When the ratio X:OH = 2 (characteristic for the upper bound of the gel formation range) is reached in the surface layer, a three-dimensional structure formation process begins that entails the formation of a surface film. The gel formation process eventually extends throughout the entire thickness of the material, culminating in complete vulcanization of the material. As a result, both types of starting functional groups are virtually completely depleted. The first stage of the process of vulcanization of two-component systems, on the other hand, is a stage of hydrolysis of tin dialkyldicarboxylate. The rate of the said reaction is proportional to the concentration of tin alkyldicarboxylate and water and inversely proportional to the concentration of acid. In the second stage of the process, the resultant tin derivative reacts with tetraethoxysilane to form a trifunctional organosilicon-tin compound (designated compound A). When there is an excess of tetraethoxysilane and water in relation to the dialkyldicarboxystannane, a hexafunctional compound (designated compound H) may also form. As a result of the shift in electron density, the silicon atoms of the trialkoxysilyl group of the two compounds A and H have a positive charge when compared with the silicon atom of tetraethoxysilane, which ultimately facilitates the formation of a compound designated compound B. Thus it is the compounds A and H rather than tetraethoxysilane that function as a cross-linking agent. On the basis of those models, the following areas of differences between the vulcanization of one- and two-component systems were identified: (1) chemical activity and function of the cross-linking agents used; (2) requirement that moisture be present for vulcanization to occur; (3) dependence of the vulcanization rate on the concentration of components of the cross-linking system; and (4) adhesion properties of the final vulcanized rubber. The following general laws of the vulcanization of α,ω -dihydroxypolydiorganosiloxanes in one- and two-component systems were formulated: (1) The foundation of the processes is the reaction of heterofunctional condensation of SiOH and SiX groups,

which occur at a high rate at room temperature; (2) in two-component systems, the development of structure formation processes is preceded by the formation of organosilicon-tin compounds in which the SiOR groups have been activated and assume the function of cross-linking agents; and (3) in both types of systems, vulcanization occurs in accordance with Flory's gel formation equation (in one-component systems, gel formation occurs in the direction of self-balancing on account of a decrease in the excess of SiX groups, whereas in two-component systems it occurs on account of the reduction in SiOH groups). Table 1; references 21; 1 Russian, 20 Western.

Russia: Accelerated-Vulcanization Organosilicon Composites

964D0746C Moscow KHIMICHESKAYA
PROMYSHLENNOST in Russian Nov 95
No 11, pp 691-694

[Article by S.R. Nanushyan, Ye.I. Alekseyeva, and A.B. Poleyev; UDC 547.1'128]

[FBIS Summary] Among those organosilicon composites known as accelerated-vulcanization composites are oligoorganosiloxane-based materials with functional groups at the silicon atom that may undergo vulcanization under the effect of various catalysts, initiators, irradiation, or other factors without the release of any by-products. Scientists at the State Scientific Research Institute for the Chemistry and Technology of Heteroorganic Compounds [GNIKhTEOS] have been working to develop accelerated-vulcanization composites for more than 25 years. In general, accelerated-vulcanization materials may be divided into three groups: materials produced by peroxide vulcanization; materials solidified through a hydrosilylation reaction; and materials vulcanized by ultraviolet irradiation. Materials of the first type were developed in the 1970s and represent composites based on oligovinylorganosiloxanes vulcanized by heating in accordance with a radical mechanism by using peroxide initiators such as dicumylperoxide. Typical materials belonging to the said group have come to be used widely in electrical engineering to impregnate the windings of various electrical machines/devices designed to work at temperatures between -60 and 250°C. The drawback of the said materials is that they require lengthy vulcanization at rather high temperatures (up to 220°C). The second group of accelerated-vulcanization composites do not require such high temperatures to solidify and, in a number of cases, can be vulcanized rather quickly even at room temperature. The said composites are generally mixtures of various alkenyl and hydride-oligosiloxanes and may be vulcanized by using various complex compounds (primarily complexes of platinum

with unsaturated organosilicon ligands). The strength of the said composites hinges on correct selection of the structure and concentration of the oligohydridesiloxane used as the cross-linking agent; the strongest composites are produced when there is a significant molar excess of Si-H groups. Extensive research to fine-tune the formulas and processes used to produce composites via a hydrosilylation reaction has resulted in a wide range of glassy, elastomeric, and gel-like materials that have come to be widely used in various fields. In the past few years, scientists at the GNIKhTEOS have also worked intensively to create formulas for and study the properties of composites vulcanized by ultraviolet irradiation. Some composites have even been developed that will harden under the effects of visible light without no heat. The products, which have been assigned the trademark SIEL and individually designated UF-1 through UF-4, are characterized by the indicators: n_D^{20} , 1.41 to 1.44; t_g , -126 to -60; Shore hardness, 30 to 60; σ_b , 1.5 to 2.5 MPa; L, 30 to 260 percent; and dP at 200°C for 30 minutes, 1.5 to 3 percent. From the standpoint of their physicochemical, optical, physicochemical, electrical, and other characteristics, the new composites are on a par with and in some cases superior to similar materials produced by such firms as Dow Corning and Shin-Etsu. Tables 4; references 10: 9 Russian, 1 Western.

Ukraine: Formation of Surface Structures During Electrochemical Deposition of Polypyrrole Films

964D0759A Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Sep 95 Vol 61 No 9, pp 40-44

[Article by L.N. Ganyuk, A.N. Inozemtsev, and V.M. Ogenko, Surface Chemistry Institute, Ukrainian National Academy of Sciences, Kiev; manuscript received 27 May 93; UDC 541.64:539.211]

[FBIS Summary] Scanning electron microscopy was used to study the structure of the surface of polypyrrole films produced by electropolymerization of pyrrole in acetonitrile in the presence of salts of aromatic sulfo acids that functioned as oppositely charged ions. The synthesis process was conducted in a two-electrode electrochemical cell with no separation between the anode and cathode spaces. Flat polished stainless steel or titanium wafers served as working electrodes, and silver or silver-coated brass wafers served as auxiliary electrodes. The electrodes were placed 15 mm apart. The parameters of the electrolysis process were found to be virtually independent of the materials used for the electrodes. An elemental analysis of the films formed at electrolysis current densities of 0.05-0.08 mA/cm² established that the degree of charging (doping) of the said polymers ranged from 0.10 to 0.15e per elementary unit of polypyrrole. The current efficiency with an

average degree of doping of 0.12e was determined to reach approximately 80 percent. The resultant polypyrrole was found to have a density of 1.37 +/- 0.005 g/cm³. Current density was found to be the biggest determinant of the polypyrrole films' macrostructure. Increases in current density resulted not only in changes in the polypyrrole film's structure but also in changes in its chemical composition. An elemental analysis of films obtained at current densities of 0.3 to 2.5 mA/cm² demonstrated that the degree of doping of the polymer at those current densities amounted to 0.26 +/- 0.02e per unit. Increasing the density of the electrolysis current not only facilitated the formation of polymer films with well-developed surface structures but also resulted in changes in chemical composition that resulted in more highly doped polymers, which are much more effective as electricity-conducting materials for use in electronics. Figures 4; references 11: 1 Russian, 10 Western.

Russia: Nanostructures: Heterogeneity and Fluctuations

964D0744A Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Nov 95
Vol 69 No 11, pp 1927-1941

[Article by V.F. Kiselev, Physics Department, Moscow State University imeni M.V. Lomonosov, and S.F. Timashev, Russian Federation State Research Center "Physicochemical Institute imeni L.Ya. Karpov Scientific Research Institute imeni L.Ya. Karpov," Moscow; manuscript received 13 Jul 94; UDC 541.1]

[FBIS Summary] The characteristic structural features and physicochemical properties of solid-phase systems consisting of functional elements with dimensions in the nanometer range were analyzed, and the available literature on the topic was reviewed. Special attention was paid to the interconnection and formation of the physicochemical properties of the surface and bulk phases of such systems. The structural nonequilibrium of lengthy fragments and the related delay in relaxation of the resultant "macrofluctuations" (dynamic electron-configuration excitations) were examined in detail. Also discussed were the locally highly nonuniform electrical fields and fields of mechanical stresses that dictate the electrophysical and optoelectronic properties of nanostructures and their catalytic and photocatalytic activity. The promise of using flicker-noise spectroscopy to study dynamic phenomena in nanostructures and the evolution of their functional properties was demonstrated. Among the main points made in the analysis are the following: Although diverse data have been collected regarding the unique features of the "bulk" and "surface" of small particles with characteristic dimensions ranging from fractions of a micrometer to nanometers and about the ad-

sorbents, catalysts, composites, etc., made from them, much less attention has been paid to the problems of the relationship between bulk and structure. Studies of nanostructures have largely focused on the problem of establishing their quasiequilibrium properties and have been far less concerned with their dynamic properties. Despite the fact that nanostructures are by and large characterized by high degrees of nonequilibrium, the relaxation processes occurring in nanostructures are generally analyzed through quasiequilibrium statistical approaches based on an acceptance of the ergodic hypothesis that all of the possible intermediate and end states occurring in a nanostructure during the course of processes of relaxation restructuring occur in accordance with their statistical weights. When problems of the transfer of components through a disordered system are examined, the concept of "level of occurrence" (which assumes a state of quasiequilibrium) is introduced and the possibility of local rearrangement of structure is excluded. In many cases, the validity of such ideas and approaches is questionable. Under conditions of intensive transfer or transfer in structurally inhomogeneous media, where dynamic restructuring of a system is possible, the conventional statistical hypothesis is invalid. The inevitability of flicker noises (1/f-noises, where f stands for frequency) is a well-known fact. Flicker noises may, for example, be observed when an electric current passes through the metal and semiconducting elements of electronic devices. It is also significant that the spectral density of the flicker noise developing in solid-phase systems increases as the system's bulk decreases and is rather high in the vicinity of contacts, thin films, filaments, etc. In addition, nanostructures possess a number of other specific properties that may appear when they are excited by electric and magnetic fields or radiation, and the states of interfaces may influence "bulk" quantum effects in systems involving components with very small dimensions. The studies on flicker noise that have been published pave the way for obtaining direct information not only about the states of nanostructures but also about the functional changes that occur in them during the course of their operation. Figures 9; references 88: 53 Russian, 35 Western.

Rumia: Effect of Supply Voltage Parameters on the Sensitivity and Selectivity of Semiconductor Sensors During Analysis of Simple Gases in a Moist Atmosphere

964D0744B Moscow ZHURNAL FIZICHESKOY
KHIMII in Russian Nov 95
Vol 69 No 11, pp 2026-2029

[Article by L.Yu. Kupriyanov and S.A. Zavyalov, Russian Federation State Research Center "Physicochemical Institute imeni L.Ya. Karpov Scientific Research Insti-

tute imeni L.Ya. Karpov," Moscow; manuscript received 11 Jul 94; UDC 541.128.3]

[FBIS Summary] A study examined the sensitivity and selectivity of a ZnO sensor coated with a thin layer of condensed water as a function of the shape and amplitude of supply voltage. The experiments were performed in a flowthrough unit. Argon that had been purified by passing it through a catalytic purification system served as the carrier gas. The gas was separated into two streams with equal flow rates. Microconcentrations (10^{-3} - 10^{-4} percent by volume) of hydrogen or oxygen were mixed into one of the flows. The stream of pure carrier gas and the gas stream containing the gaseous impurity to be measured were alternatively fed into the flowthrough measuring cell containing a sensor made from a polycrystalline sintered film of zinc oxide applied to a quartz substrate with baked-in platinum contacts. Before entering the measuring cell, the streams were first passed through a sparger filled with twice-distilled water, where they were saturated with water vapor. During the measurement process, a voltage in the form of a single step or series of bipolar rectangular pulses was fed to the film. The G6-28 pulse generator used as the voltage source made it possible to vary the amplitude of the voltage between 0.1 and 10 V and the pulse-following frequency between 10^3 and 1 Hz. The transient characteristics of the current passing through the sensor were measured as voltages with different shapes and amplitudes were fed to it. The adsorption response of the current passing through the sensor when the different gas streams were fed through the measuring cell was also measured. At voltages above 2 V, the electrophysical processes occurring in the system acquired a nonlinear, long-term nature. The observed changes in the current's relaxation were interpreted as indicating that the application of a lengthwise electrical field stimulates not only relaxation of the electrophysical parameters in the zinc oxide film but also processes of charged adsorption and desorption of molecules of the gas dissolved in the layer of liquid condensed on its surface. When a series of bipolar pulses were fed to the film rather than a voltage in the form of a single step, the enormous conduction relaxation times associated with the latter form of supply voltage were greatly reduced, thus making the ZnO sensor-based analysis method suitable for use in practical gas analysis. Furthermore, by using a series of bipolar pulses, the researchers were not only able to obtain an absorption response signal to trace amounts of oxygen in argon as other researchers have but were also able to also obtain a response signal to trace amounts of hydrogen, which had not been previously accomplished at room temperature. To determine whether the observed response of the ZnO sensor was unique to the model system studied, an additional

experiment was performed in which the ability of the ZnO-based sensor to detect concentrations of hydrogen selenide in H_2 in a concentration of 10^{-4} percent by volume was examined. A clear relationship between the sensor's sensitivity and the magnitude of the applied voltage was observed. The experiments thus confirmed that the study ZnO-based sensors' sensitivity and selectivity in relation to the simple gases hydrogen, oxygen, and hydrogen selenide in the presence of saturated water vapor may indeed be regulated by varying the amplitude and frequency of the supply voltage. Figures 4; references 11 (Russian).

Russia: New Variations of Chromatographic Separation

964D0744C Moscow ZHURNAL FIZICHESKOY
KHIMII in Russian Nov 95
Vol 69 No 11, pp 2056-2058

[Article by M.F. Gumerov, Scientific Research and Technology Institute, Sosnovyy Bor, Leningrad Oblast; manuscript received 9 Nov 94; UDC 543.544]

[FBIS Summary] Two new versions of chromatographic separation were examined, namely, ion stream chromatography and gas-chromatographic separation of substances in ion form. In the ion stream chromatography procedure, a gaseous substance is ionized, and the resultant ions pass through the column at a constant speed together with the stationary phase. The ion stream assumes the role of the mobile phase. The mixture of substances introduced into the system mixes with the ion stream, and as they move along, the components of that system interact with the stationary phase in one way or another. Obviously, the proposed process is especially suited to separating mixtures consisting of components that have already been ionized. In theory, it may also be used to separate substances in electroneutral form if the ionization energy of the components is greater than the ionization energy of the substance that is the source of the ion stream; however, its benefits over conventional separation procedures in such cases are negligible. The key feature of ion stream chromatography is that the ions interact directly with the stationary phase, whereas in ion-exchange and ion chromatography, for example, the components are associated with a specified number of molecules of the eluent that act as a unique type of buffer. A number of technical problems may arise during attempts to implement ion stream chromatography. First and foremost is the problem of the formation of an enormous number of like-charged ions per unit of volume. The process flow according to which the pressure of the gaseous substance used as the ion source is either far above or far below atmospheric pressure is therefore interesting. Also interesting is a proposed process

flow in which the ion stream is diluted with a carrier gas that has an ionization energy significantly higher than that of the substance serving as the ion source. The problem of detection of the separated components may be solved by neutralizing the ions of the separated substances emerging from the column and the ions of the mobile phase and subsequently detecting them in accordance with the standard process flow. In all likelihood, the purity of the gas serving as the ion stream source does not need to be held to standards as rigorous as those required when ionization (helium or argon) detectors are used because of the assumption of the establishment of equilibrium between the mobile and stationary phases. The second recently proposed technique, namely gas-chromatographic separation of substances in ionic form, presupposes a new level of interaction in the system component-stationary phase that should in turn boost the separating ability of the chromatographic system as a whole and thus make it possible to greatly reduce the lengths of the columns used to separate such substances as electroneutral forms of argon and oxygen at room temperature. Because of their very high ionization energy, those gases that are most commonly used as carrier gases now (helium, neon, argon, nitrogen, and hydrogen) should not pose any problems when used in the gas-chromatographic separation of substances in ionic form. Sorbents whose surfaces are free of ions and functional groups and that are capable of strong specific interaction (type I sorbents according to A.V. Kiselev's classification) appear to be best as stationary phases. Subjecting ions to gas-chromatographic elution as they move counter or perpendicular to an electrical field will make it possible to develop new continuous separation and analysis processes that will likely be superior to existing processes from a number of standpoints. Gas-chromatographic separation of substances in ionic form will also afford new possibilities with respect to detection, especially when ionization detectors are used, because the detector will not react directly to an already prepared packet of ions. Gas-chromatographic separation of ions is a process that lies somewhere between gas stream chromatography and ion stream chromatography. Both ion stream chromatography and gas-chromatographic separation of substances in ionic form can significantly expand the sphere of use of chromatographic methods. References 16: 12 Russian, 4 Western.

Russia: Conservation of Singlet Oxygen on Finely Dispersed Quartz and Its Role in the Formation of 'Ozone Holes' in the Earth's Atmosphere

964D0744D Moscow ZHURNAL FIZICHESKOY
KHIMII in Russian Nov 95
Vol 69 No 11, pp 2109-2110

[Article by I.A. Myasnikov, Russian Federation State Research Center "Physicochemical Institute imeni L.Ya. Karpov Scientific Research Institute imeni L.Ya. Karpov," Moscow; manuscript received 10 Apr 95; UDC 541.183]

[FBIS Summary] An experiment that was conducted in a reaction vessel described elsewhere has established that finely dispersed quartz promoted by such organic dyes as methylene blue, tryptamine, and Bengal rose and by other aromatic compounds such as anthracene can serve for many hours as a conservator of singlet oxygen, 1O_2 ($^1\Delta_g$) formed on its surface as a result of illumination of the adsorbent with visible light for 2 to 10 minutes at temperatures near or below 0°C. The photoformation of 1O_2 molecules in the presence of organic compounds and triplet oxygen is, of course, a well-known phenomenon. What is new is the discovery of molecules of 1O_2 existing for many hours in a latent state at reduced temperatures on the surface of a solid body promoted by organic compounds. The process of reactivating an adsorbent containing singlet oxygen consists of heating it to room temperature, which results in the release of singlet oxygen into the atmosphere in one and the same quantity no matter how long the adsorbent had been stored after having been illuminated. The experiments demonstrated that as the temperature at which the singlet oxygen-containing adsorbents are stored is decreased, the amount of singlet oxygen lost decreases significantly and becomes infinitesimal at temperatures just 5-10° below 0°C. The experiments further established that regardless of the pressure of the triplet oxygen in the reaction vessel, as the degree to which the adsorbent's surface is filled with molecules of 1O_2 and the symbiotic time of the adsorbent's exposure to light increases, the amount of singlet oxygen lost during storage increased, apparently primarily as a result of a decrease in the energy required to activate its desorption. The effect of conservation of singlet oxygen on finely dispersed quartz had previously been observed in experiments in which no promoter was used. The observed effect of long-term conservation of singlet oxygen on finely dispersed quartz both with and without promoters was discussed in terms of the possible involvement of conserved singlet oxygen on microcrystals of solid rock or ice in heterogeneous processes such as, for example, the process of destruction of the ozone layer in the upper layers of the Earth's atmosphere. It was suggested that

the mechanism of the formation and "abandonment" of such microcrystals in those layers of atmosphere may be linked to certain global processes occurring on Earth, for example, dust (sand) storms occurring in vast deserts, the grinding of rock into fine dust with a chemically active irregular surface structure, volcanic activity, and snowstorms. The possible role that microparticles of solid rock or ice that have adsorbed traces of atmosphere-polluting organic compounds of natural or industrial origin play in the development of holes in the ozone layer was discussed. Figure 1; references 4: 3 Russian, 1 Western.

Russia: Sorption-Kinetic Properties of the Sorbent Termoksid-3A

964D0758A St. Petersburg RADIOKHIMIYA
in Russian Vol 37 No 6, Nov-Dec 95 pp 554-556

[Article by V.M. Komarevskiy and N.Yu. Kremlyakova, Geochemistry and Analytic Chemistry Institute imeni V.I. Vernadskiy, Russian Academy of Sciences, Moscow; manuscript received 5 May 95; UDC 661.183]

[FBIS Summary] Termoksid-3A is a sorbent with the chemical formula $Zr(HPO_4)_2 \cdot H_2O$. It is being produced in pilot-commercial batches by the Titan Joint-Stock Company in the form of highly uniform (from chemical, morphologic, and crystal chemistry standpoints) glassy spherical granules ranging in diameter from 0.25 to 0.5 mm. The granules of Termoksid-3A are characterized by good mechanical strength (approximately 25 MPa), good radiation stability (they can withstand at least 100 MGy), and good chemical stability (they are practically insoluble in water and in sulfuric and nitric acid solutions with concentrations up to 3.0-6.0 mol/l), and they hold their shape well. The sorption-kinetic properties of Termoksid-3A were studied in a series of experiments in which it was used to adsorb radionuclides of cesium and alkaline earth metals. The Na⁺ form of the sorbent, which is equivalent to a solution with a pH of 6.5 (2.3 mgEq/g), was used to extract selected radionuclides (^{90}Sr , ^{137}Ba , ^{226}Ra , and ^{137}Cs) from solutions prepared by mixing the various radionuclides with Moscow tap water in small columns with diameters of 0.5 cm and lengths between 1.0 and 2.0 cm that were placed horizontally on the NaI(Tl) crystal of a γ -spectrometer. The pH of all of the working solutions was maintained at 6.5 \pm 0.1. The mechanisms of the sorption processes occurring in the case of each radionuclide were studied. It was determined that the sorption of barium, radium, and cesium radionuclides is probably based on an ion exchange mechanism ($n < 1$ [n being a constant that depends on the mechanisms of the sorption process]) with limiting stages of external diffusion in the case of bar-

ium and radium and internal diffusion in the case of cesium. In the case of strontium, on the other hand, it was concluded that sorption probably occurs in accordance with a chemisorption mechanism ($n > 1$) that is limited by external diffusion and that involves the formation on the sorbent's surface of a layer (or proper phase) of a chemical compound consisting of the strontium and the sorbent. The experiments further demonstrated that the high sorption-kinetic properties of Termoksid-3A make it an effective means of clearing long-lived fission product radionuclides as ^{90}Sr and ^{137}Cs from bodies of water. Figures 2, table 1; references 10: 8 Russian, 2 Western.

Russia: A Study of the Behavior of Plutonium and Americium During the Vitrification of High-Level Radioactive Wastes by Producing Glassy Phosphate Composites With Different Macrocompositions

964D07588 St. Petersburg *RADIOKHIMIYA*
in Russian Vol 37 No 6, Nov-Dec 95 pp 557-562

[Article by Yu.I. Matyugin; manuscript received 18 Jan 95; UDC 621.039.73]

[FBIS Summary] A study examined the behavior of α -radionuclides during the process of vitrification of model high-level radioactive wastes into phosphate composites. A nitric acid solution containing plutonium in a concentration of 56.65 g/l and HNO_3 in a concentration of 5.5 mol/l served as the model plutonium-containing solution. The isotope profile of the solution was as follows (percent by weight): ^{239}Pu , 94.70; ^{240}Pu , 5.16; ^{241}Pu , 0.14; ^{242}Pu , 0.03. The α -spectrum of the solution was determined to be as follows: $^{239}\text{Pu} + ^{240}\text{Pu}$, 92 percent; $^{241}\text{Am} + ^{242}\text{Pu}$, 8 percent. The starting solution used to vitrify the radioactive wastes contained the following components: NaNO_3 in a concentration of 213.7 g/l; $\text{Al}(\text{NO}_3)_3 \cdot \text{H}_2\text{O}$ in a concentration of 463.0 g/l; H_3PO_4 ($\rho = 1.72$) in a concentration of 136.5 ml/l; 4 mol/l HNO_3 in a concentration of 250.0 ml/l; and $\text{Pu}(\text{IV})$ (56.65 g/l) in a concentration of 150.0 ml/l. The fused solution was subjected to various heat treatment conditions. X-ray phase analysis unequivocally established that as the fused plutonium-containing solution hardens, a plutonium dioxide phase begins to appear on diffractograms at temperatures above 600°C (thermal decomposition of pure plutonium nitrate resulting in dioxide formation occurs at 250°C). Further experiments were conducted to determine the relationships between the behavior of ^{239}Pu and ^{241}Am in glassy phosphate composites and macrocomposition of the matrix composite and the time for which the glassy melt was held. Nine different blocks of glassy plutonium-containing phosphate composites were produced by preparing three starting solutions containing different amounts of NaNO_3 , $\text{Al}(\text{NO}_3)_3 \cdot \text{H}_2\text{O}$, H_3PO_4 ,

HNO_3 , and $\text{Pu}(\text{IV})$ in quartz containers and heating them at temperatures of 100, 150, 300, and 500°F for 2.0, 1.0, 1.5, and 2.0 hours, respectively, and then dividing each of the three precalcined solutions into three portions and subjecting them to additional heat treatment at 950-1,000°C for 8, 100, and 200 hours. Studies by the methods of γ -spectrometry, γ -scanning, α -radiography, mass spectrometry, and x-ray phase analysis confirmed that the distribution of plutonium and americium throughout the bulk of the vitrified materials is dictated by the composition of the liquid high-level radioactive waste used and the chosen matrix, as well as by the conditions under which the vitrification process is conducted. The composites held in the melt stage for 8 hours were crystallized and either gray or yellowish (not transparent), whereas the materials held in the melt stage for 100 and 200 hours were largely transparent and dark brown, with a nontransparent yellowish bottom layer. The plutonium in the blocks held for 8 hours was distributed virtually evenly throughout the blocks, whereas the plutonium in the blocks held for longer periods was largely concentrated in the blocks' bottommost layers. The americium, on the other hand, was distributed virtually evenly throughout all of the blocks regardless of the various blocks' macrocompositions or the amount of time for which the material used to form them was held in the melt stage. Overall, the studies indicated the limited solubility of the study plutonium in glassy phosphate composites. Figure 1, tables 8; references 17: 6 Russian, 11 Western.

Russia: Using Track Membranes To Transport Ions From a Liquid to a Gaseous Phase

964D0743A Moscow *KHIMIYA VYSOKIKH ENERGII*
in Russian Vol 29 No 6, Nov-Dec 95 pp 421-422

[Article by B.S. Yakovlev, deceased, Institute, Russian Academy of Sciences, Chernogolovka, Moscow Oblast; manuscript received 29 Nov 93; after revision 15 Apr 94; UDC 541.15]

[FBIS Summary] The already-familiar technology for producing thin polymer films containing channels with diameters ranging from several tens of angstroms to several microns may be used as a basis for what are known as track membranes by bombarding continuous polymer films with high-energy ions and then subjecting them to ultraviolet light and chemical etching. Next, two electrodes are positioned so that one is in a vacuum close to the membrane and the other is applied to the membrane's surface. The electrodes are used to create an electrical field that will draw ions from the liquid into a vacuum. Two fundamental problems must be solved for such a membrane to operate successfully. The first is the problem of creating a high-intensity

electrical field at the protective liquid-vacuum interface. The second is the problem of stabilizing the protecting liquid in the membrane's channels, or in other words, creating conditions where atmospheric pressure and a strong electrical field will not destroy the surface of the liquid at the liquid-vacuum interface. The problem of the ions' survival as they are transported along the membrane's channels must also be considered. Several prototype track membranes have been created that apparently solve the aforesaid problems. Unfortunately, the properties of such membranes manufactured by a single process are not sufficiently reproducible. Those prototypes possess the following properties: (1) the current emitted from the membrane channels can remain stable at a level of 10^{-7} A for a long time provided that there is a voltage of several kilovolts between the two electrodes; (2) the energy distribution of the ions emitted from the membrane is rather narrow (data obtained by the delay potential method indicate that the width of the retarding potential at the half-height does not exceed 7 percent of the possible peak energy that the ions may have when the passing through the potential difference applied to the electrodes); and (3) the membrane emits mainly ions and not charged particles. The creation of portable mass spectrometers to analyze the ion composition of liquids is evidently one of the most promising directions in the use of membranes for transporting ions from a liquid into a vacuum. Figures 3; references 5: 2 Russian, 3 Western.

Russia: Study of Adsorption Properties of Silica Gels With an Applied Fullerene Layer

964D0767A Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA - SERIYA 2 KHIMIYA in Russian Vol 36 No 6, Nov-Dec 95 pp 518-522

[Article by V.Ya. Davydov, T.M. Roshchina, G.N. Filatova, N.M. Khrustaleva, Physical Chemistry Department, Moscow University; manuscript received 1 Feb 95; UDC 543.544.541.183]

[FBIS Summary] Gas chromatography was used to study the properties of adsorbents with an applied fullerene layer for the purpose of identifying the characteristics of intermolecular interactions of fullerene molecules with organic compounds. Both hydroxylated silica gel (Silipor-015 [Czech Republic] with a specific surface s of $20 \text{ m}^2/\text{g}$) and silica gel with an applied carbon layer (Silipor-015 with $s = 21 \text{ m}^2/\text{g}$) were used as carriers. The carbon layer was applied by an improved method of decomposing CCl_4 at $400-420^\circ$. The adsorbents were coated with enough fullerene to create three or four single layers of C_{60} on the silica gel. In the case of the silica gel without the carbon layer, the fullerene was applied from a CCl_4 solution. In the

case of the silica gel with the applied carbon layer, the fullerene was applied from a $\text{C}_6\text{H}_6\text{CH}_3$ solution. The resultant adsorbents had specific surfaces of 14 and $16 \text{ m}^2/\text{g}$, respectively. In addition, samples of Silipor-030 were coated with an 85:15 mixture of the fullerenes C_{60} and C_{70} by pouring a saturated benzene solution of the fullerene mixture onto the adsorbent and allowing the benzene to evaporate. The adsorbents' specific surfaces were determined from the adsorption isotherms of nitrogen at -196° by the Brunauer-Emmett-Teller method on a Micromeritics surface and porosity analyzer (United States). The chromatography studies were conducted on a Khrom-5 chromatograph (Czech Republic) with a flame ionization detector with helium serving as the carrier gas and glass columns measuring approximately $50 \text{ cm} \times 3 \text{ mm}$. The application of a fullerene layer significantly changed the properties of the starting adsorbents. For example, when samples of Silipor-030 were coated with the aforesaid fullerene mixture and then used to separate selected ethers, the volume of ether retained on them was much lower than retained on the samples of Silipor-030 that had not been coated with the fullerene mixture. The comparison of the fullerene-coated and untreated samples of Silipor-030 indicated screening of the silanol groups of the silica gel's surface and molecular interaction of the adsorbed molecules with the fullerene molecules on the surface of the adsorbents. The amounts of each of 14 organic compounds retained on four types of Silipor-015 adsorbents were calculated and compared: (1) the starting Silipor-015 adsorbents; (2) Silipor-015 adsorbents with the applied carbon layer; (3) Silipor-015 adsorbents that were coated with the fullerene C_{60} without first having been coated with a layer of carbon; and (4) Silipor-015 adsorbents that were coated with the fullerene C_{60} after having first had a carbon layer applied to them. The amounts of the various compounds retained by the first two groups of adsorbents all differed significantly, whereas the amounts retained by the third and fourth groups were comparatively similar in all cases, thus establishing that the adsorbent properties of the study adsorbents were determined primarily by the presence of a fullerene on their surface. Gas chromatography was used to quantitatively characterize the intermolecular interactions of the adsorbed molecules with the fullerene on the adsorbents' surfaces, and the calculated contributions were presented in table form. It was cautioned, however, that when those results are interpreted, allowance must be made for the fact that some segments of the surfaces of the adsorbents coated with fullerene still retained segments that remained free of fullerene. Figures 4, tables 3; references 10: 3 Russian, 7 Western.

Russia: Synthesis of Heat-Resistant Fluorine-Containing Homopolymers and Copolymers Based on Vinylthiofluorobenzenes and Styrene

964D0822A Novosibirsk *KHIMIYA V INTERESAKH USTOYCHIVOGO RAZVITIYA* in Russian Jan 96
Vol 4 No 1, pp 9-14

[Article by S.V. Amosova, L.I. Antsiferova, V.I. Gostevskaya, and G.M. Gavrilova, Irkutsk Institute of Organic Chemistry, Siberian Department, Russian Academy of Sciences, Irkutsk; manuscript received 16 Jun 95; UDC 541.64:542.462]

[FBIS Summary] A no-waste method was developed for synthesizing heat-resistant polymeric materials that contain both fluorine and sulfur atoms simultaneously and that are based on 1,4-difluoro-2,3,5,6-tetrakis(vinylthio)benzene (I) and 1,2,4,5-tetrafluoro-3,6-bis(vinylthio)benzene (II). The two vinylthiofluorobenzenes were synthesized from hexafluorobenzene and divinylsulfide as described in a previous publication. Compound I is a stable compound in the form of cream-colored acicular crystals with a melting point of 74-75°C (from ethanol), and compound II is a stable compound in the form of a transparent liquid with a boiling point of 106-108°C/4 mm Hg. Both compounds are odorless and soluble in organic solvents, and both have good heat resistance: They have proved capable of withstanding temperatures of 240 to 470°C without experiencing any mass loss. Compound I was shown to be easily polymerized in accordance with the radical mechanisms at high rates without an initiator when heated to 90-120°C or under conditions of initiation by azobisisobutyronitrile, in which case transparent blocks or a yellow-brown film is formed. Compound II is less active under conditions of radical polymerization, yielding a yellow powder. When compounds I and II are polymerized in accordance with the cation mechanism in the presence of SnCl₄ or TiCl₄, high-molecular weight compounds are formed in the form of dark brown powders. Thirteen homopolymers of compounds I and II were produced in near-100 percent yields. Regardless of the method used to synthesize the homopolymers, all of the polymeric products were insoluble in organic solvents, strong acids, or alkalis. A study of the structure of the polymers formed in the early stages of the polymerization process (after only approximately a 5-percent conversion) revealed that even in the beginning of the reaction, partially cross-linked and highly swollen polymers are formed: swelling of 4,200 percent (acetone) and 5,800 percent (benzene) in the case of one of the homopolymers synthesized from compound I and swelling of 8,770 percent (acetone)

and 11,290 percent (benzene) in the case of one of the homopolymers synthesized from compound II. In later stages of the transformation process, the homopolymers manifested a densely joined cross-linked structure, the infrared spectra recorded for all of the study specimens were identical and contained highly broadened bands. Gravimetric analysis established that homopolymers synthesized in the form of films based on compound I were the most heat-resistant. Films based on compound I and synthesized by thermopolymerization without an initiator proved capable of withstanding a temperature of 470°C with no mass loss and experienced a 20 percent mass loss at 640°C. Powder homopolymers of compound I synthesized under conditions of cationic polymerization remained unchanged at temperatures of 300°C but lost approximately 20 percent of their mass at 500°C. The compounds produced by copolymerization of styrene with compounds I and II (in concentrations ranging from 2 to 33 molecular percent) in the presence of the radical initiator azobisisobutyronitrile in a solvent, in the mass, or in a suspension at 70-80°C were also produced in high yields (88.1-99.9 percent). The copolymers were glassy solid blocks with colors ranging from light yellow to brown. They all swelled in benzene and all had better thermal and strength properties than polystyrene and copolymers of styrene and divinylbenzene. Figures 2, tables 4; references 6 (Russian).

Russia: Catalytic Hydrogenation of Brown Coals From the Kansk-Achinsk Basin (Russia) and Yellow Urn Deposit (Australia) Into Pure Liquid Fuels

964D0822B Novosibirsk *KHIMIYA V INTERESAKH USTOYCHIVOGO RAZVITIYA* in Russian Jan 96
Vol 4 No 1, pp 37-44

[Article by Y. Kageyama, T. Kaneko, K. Tazawa, and N. Okiyama, Nippon Brown Coal Liquefaction Company Limited, Takasago Laboratory, Niitama, Japan, I. Saito, National Institute for Resources and Environment, Onogawa, and P.N. Kuznetsov, Chemistry and Chemical-Metallurgical Processes Institute, Siberian Department, Russian Academy of Sciences, Krasnoyarsk; manuscript received 16 Jan 96; UDC 662.74:311.17]

[FBIS Summary] Brown coal from the world's two largest brown coal basins, namely, the Kansk-Achinsk Basin in Russia and the Yellow Urn Basin in Australia, was compared from the standpoint of suitability as a source of alternative pure liquid hydrocarbon fuel. Samples of coal from the two basins were examined to determine their material, elemental, and functional compositions as well as their physical and molecular structure. The study samples of Kansk-Achinsk were collected from three different deposits (the Borodinskoye, Bere-

zovskoye, and Abanskoye deposits). The Australian coal had a moisture content of 61.3 percent, while the Kansk-Achinsk coal had a moisture content of 16-18 percent (30-35 percent in the case of freshly mined coal). The Kansk-Achinsk coal was found to have an ash content of 4.3-8.6 percent, while the Australian coal has an ash content of 1.0 percent. When compared with the ash of the Australia coal, the ash of the Kansk-Achinsk coal was found to contain a higher concentration of alkaline earth metals (mainly calcium) and a relatively low concentration of iron (30-50 percent calcium and 8-12 percent iron in the case of the Kansk-Achinsk coal versus 15-30 percent calcium and 20-30 percent iron in the case of the Australian coal). The coal from the Abanskoye deposit had the highest surface area (31.4 mg/g). The other two samples of Kansk-Achinsk coal and the Australia coal all had surface areas ranging from 11.5 to 14.5 m²/g. The Australian coal had a much smaller pore size (0.35 cm³) than the Kansk-Achinsk coals (0.41-0.58 cm³). Samples of the study coal were were subjected to catalytic hydrogenation under various conditions. The brown coal mined from three deposits in the Kansk-Achinsk Basin proved superior to samples of the Australian coal from the standpoints of depth of transformation and yield of valuable fractions of liquid products. The Kansk-Achinsk coal was superior to the Australian coal both in tests involving the catalytic hydrogenation process developed at the Mineral Fuels Institute of the Russian Federation Ministry of Fuel and Energy (IGI), i.e., hydrogenation in a medium of oil and coal paste-forming agents at a temperature of 425-430°C and working hydrogen pressure of 10-12 MPa, and in tests involving the process developed by the Japanese firm Nippon Brown Coal Liquefaction (NBCL), i.e., a process of catalytic hydrogenation at a temperature of 450°C and working hydrogen pressure of about 15 MPa that is conducted in a medium of 1-methylnaphthalene and in the presence of an iron oxide catalyst with elemental sulfur added. When compared with the gasoline fractions obtained from the Australian coal, the gasoline fractions obtained from the Kansk-Achinsk coal contained more aromatic hydrocarbons and a lower number of alkyl substituents, and their aliphatic structures had shorter carbon chains. The differences between the higher-boiling fractions of liquid hydrogenation products obtained from the Kansk-Achinsk and Australian coals were less pronounced. Figure 1, tables 8; references 16: 7 Russian, 9 Western.

Russia: Controlling Superecotoxics in Environmental Objects and Sources of Its Pollution
964D0804A Moscow ZHURNAL ANALITICHESKOY
KHIMII in Russian Feb 96 Vol 51 No 2, pp 163-172

[Article by N.A. Klyuyev, Institute for Problems of Ecology and Evolution imeni A.N. Severtsov, Russian Academy of Sciences, Moscow; manuscript received 24 Apr 95; UDC 502.3:534.064:543.51:547.621:614.31]

[FBIS Summary] Superecotoxics are compounds that are capable even in doses as low as 1×10^{-9} to 10^{-10} g/g or g/ml of inducing and/or inhibiting vital enzymes (enzymes to the cytosol Ah receptor controlling activation of genes A1 and A2 on human chromosome 15 and accumulation of the nonspecific monooxygenases cytochrome P-4501A1 and P-4501A2). Before steps can be taken to protect the environment from such superecotoxics as polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF), polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH), and polychlorinated phenols (PCP), accurate assessment of current levels of superecotoxics and trends in the accumulation of superecotoxics are needed. That information can only be obtained through analytic measurements. At present, the most reliable methods of determining levels of superecotoxics (PCDD and PCDF) involve the use of isotope-labeled standards and the combination of capillary gas-liquid chromatography with high-resolution mass spectrometry (tandem mass spectrometry). PCP may be detected by capillary gas-liquid chromatography with an electron-capture detector, and PAH may be detected by high-performance liquid chromatography with a fluorescence detector. Because of superecotoxics' extremely high toxicity, the concept of maximum permissible concentrations is virtually meaningless in relation to them. In the United States, levels of PCDD and PCDF are measured by methods developed by the Environmental Protection Agency. In Russia, the only method for detecting superecotoxics to be certified by the Russian Federation Committee on Standardization, Metrology, and Certification (Gosstandart) to date is one developed for determining PCDD. The Russian Federation's eco-analytic services have no available methods for making accurate analytic measurements of most superecotoxics because they have no isotope-labeled state standard specimens for PCDD and PCDF, no state standard specimens for measurement of PCP, and no standard mixtures for measuring PCB. A new system of internal standards for dioxins based on fluoro- and trifluoroethyl derivatives has been proposed. The said compounds were approved as state standard specimens in 1995. At present, the only Gosstandart-approved method for collecting samples of superecotoxics is a method for collect-

ing water samples. Rules for collecting samples of atmospheric air, waste gases, and soil were approved in 1995. To date, no approved methods exist for collecting samples of regional flora and fauna or foodstuffs. The Russian Federation has no normative documents regarding the process of determining superecotoxics with consideration for the diverse types of matrix material in which they may be located. No high-resolution or low-resolution chromatograph-mass spectrometers meeting international requirements for accurately measuring levels of superecotoxics are currently being manufactured in Russia. The situation with regard to gas-liquid chromatography is somewhat better. The Kristall-2000, Kristall-3000, and Tivet chromatograph are good instruments; however, they are not equipped with polar capillary columns capable of maintaining temperature conditions without any phase loss or separating toxic isomers of PCDD, PCDF, and PCB. The main sources of chromatographs and chromatograph-mass spectrometers in the Russian Federation are the firms Finnigan (United States-Germany), VG (Great Britain), and Hewlett-Packard. It appears unlikely that the Russian Federation will be producing any analogous instruments any time soon. Many EPA-approved standardized sample collection and preparation procedures are unsuitable for use in laboratories within the Russian Federation for purely technical reasons (for example, the lack of solvents, sorbents, etc., with the required degree of purity). The following are other areas related to the monitoring of superecotoxics in environmental objects where the Russian Federation needs to make significant improvements: development of methods for making quick determinations of the levels of superecotoxics in environmental objects; preparation/training of analytic chemists in modern methods of analyzing and identifying components of complex matrices of natural origin; and controlling the quality of the analytic data collected during the process of detecting/determining levels of superecotoxics. Tables 3; references 55: 31 Russian, 24 Western.

Russia: Continuous Separation of Gaseous and Highly Volatile Impurities From Aqueous Solutions by the Membrane Chromatography Method
964D0804B Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Feb 96 Vol 51 No 2, pp 215-218

[Article by L.N. Moskvina, O.V. Rodnikov, and A.N. Katuzov, Chemistry Scientific Research Institute, St. Petersburg State University, St. Petersburg; manuscript received 10 May 94; UDC 543.544]

[FBIS Summary] A new membrane chromatography method has been developed for continuous separation

of gaseous and highly volatile compounds from aqueous solutions. The said compounds are extracted into a flow of gas phase so that they can be subjected to gas chromatographic analysis. The unit in which the new extraction method was performed consisted of a regulator valve to control the rate at which the aqueous study sample was fed into the unit, a mass exchange layer, a membrane chromatography cell, a gas flow regulator, a microporous membrane, a metering loop, a metering cock, and a gas chromatograph. An aqueous solution containing a known quantity of the gaseous components that were to be identified was passed through a regulator valve at a specified flow rate and then through the mass exchange layer of the membrane chromatographic cell, after which it was discharged. At the same time, the flow of extracted gas was directed through a flow regulator at a specified rate and then onward through microporous membranes and the aforesaid mass exchange layer, after which it was directed into the metering loop of the gas chromatograph's metering cock. The aqueous and gaseous phase flows moved in mutually perpendicular directions. Two processes of continuous separation of volatile impurities from aqueous solutions were examined: equilibrium saturation and complete extraction. The equilibrium saturation regimen was concluded to be rational for determining most volatile organic compounds that dissolve in water fairly easily and that have distribution coefficients below 1. As far as water-soluble gaseous compounds with distribution coefficients much greater than 1 are concerned, equilibrium saturation was concluded to only make sense in cases of low concentrations where the maximum possible concentration coefficients must be reached. A regimen of complete extraction was said to be preferable in most cases because the effect of temperature on the distribution coefficient could be excluded. The effectiveness of the new membrane chromatography membrane was evaluated by comparing the degree of extraction of dissolved gases in a membrane chromatography cell and in a bubbler used to conduct counterflow gas extraction. The geometric dimensions of the bubbler and membrane chromatography cell were identical. A higher efficiency of extraction was achieved in the membrane chromatography cell than in the bubbler. It was concluded that from a metrology standpoint, a stationary regimen of complete extraction of dissolved gases in a membrane chromatography cell is preferred over a regimen of partial extraction in a bubbler. Analogous benefits were found when highly volatile organic impurities were determined in water in a regimen of equilibrium saturation. Figures 5; references 5 (Russian).

Russia: Partly Coherent Acoustic Images in Stratified Refraction Waveguides

964D0947A Nizhny Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian
Vol 38 No 1-2, Jan-Feb 95 pp 127-133

[Article by N. A. Sidorovskaya and A. I. Khilko, Applied Physics Institute, Russian Academy of Sciences, Nizhny Novgorod; manuscript received 1 Feb 95; UDC 534.26]

[FBIS Summary] The authors analyze possibilities of constructing partly coherent acoustic images for plane-stratified geophysical waveguides. Specifically, the paper gives results of structural analysis of the imaging system's contrast transfer function that determines the spatial resolution of images and demonstrates capabilities of spatial filtration of components of the spatial spectrum for various degrees of coherence of the illuminating field. The results show that the use of extended illuminating noise sources for observing inhomogeneities attenuates the influence of interference noise associated with intermode interference and scattering by randomly distributed inhomogeneities of the medium. From this standpoint, incoherent illumination gives the best results. However, in practice this sacrifices the capability of spatial filtration, which is needed when observing homogeneities by tomography. Another possibility for use of partly coherent images is where noise sources of non-gaussian type are used, requiring analysis of higher-order coherence functions, enabling scattered signals to be distinguished against a background of additive noises. The research was supported in part by the International Science Foundation within the scope of grants N oo 000 and N oo 300. Figures 2, formulas 8, references 3.

Russia: Feasibility of Reconstructing Anisotropic Wind Wave Spectrum by Two-Position Sonar Method

964D0947B Nizhny Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian
Vol 38 No 1-2, Jan-Feb 95 pp 139-145

[Article by L. S. Dolin and M. I. Kondratyeva, Applied Physics Institute, Russian Academy of Sciences, Nizhny Novgorod; manuscript received 6 Feb 95; UDC 534.44]

[FBIS Summary] The paper looks at the possibility of reconstructing the spectrum of a wind-generated sea with allowance for anisotropy by the method of acoustic probing of the ocean by horizontally deployed antennas in CW operation. The method is based on using narrow-beam antennas with horizontal separation that emit a monochromatic acoustic signal and receive signals scat-

tered by the surface. Expressions are derived that relate the energy spectrum of the scattered signal generated at the output of the receiving antenna to the spectrum of the wind-driven sea. Based on these expressions, an algorithm is devised that yields information both about the spatial isotropic spectrum of wind waves, and about the way that the angle spectrum depends on the magnitude of the wave vector and its direction relative to wind velocity. Figures 3, formulas 15.

Russia: Analytical Description of Time-Dependent Diffusion in Suzuki's Scaling Limit for Broad Class of Lasing Models

964D0947C Nizhny Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian
Vol 38 No 1-2, Jan-Feb 95 pp 153-158

[Article by A. V. Polovinkin, Nizhgorodskiy State University imeni N. I. Lobachevskiy; manuscript received 31 Jan 95; UDC 539.219.3:621.382]

[FBIS Summary] An analytical study of the statistical characteristics of time-dependent diffusion of lasing amplitude in Suzuki's scaling limit for a broad class of lasing models, including one with cubic dependence of effective intensity, and one with saturation (in one-dimensional and two-dimensional cases). Formulas 18, references 6.

Russia: Nonlinear Acoustic Methods in Diagnosing Cracks

964D0943A Nizhny Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian
Vol 38, No 3-4, Mar-Apr 95 pp 169-187

[Article by A. M. Sutin and V. Ye. Nazarov, Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod; manuscript received 6 Feb 95; UDC 534.222]

[FBIS Summary] The paper is a brief survey of theoretical and experimental studies of nonlinear acoustic effects due to the presence of cracks in solid media, and also discusses the possibilities of using these effects for crack diagnosis. A physical model of a crack is proposed, and is used as a basis for developing a model of a cracked medium that explains the physics of interaction of acoustic waves in such media, and the anomalously high nonlinearity of solids that contain cracks. Further research is needed to perfect the proposed methods of nonlinear acoustic diagnosis. The authors thank O. D. Shishkina for assistance. The work was done with the financial support of the Russian Fundamental Research Foundation (project code 94-0203508-a) and the International Science Foundation (grant No RBUR000). Figures 2, formulas 33, references 36.

Russia: Stochastic Deceleration of Particles in Coherent Pumping or Random Magnetostatic Field, and Effective Amplification of Monochromatic Electromagnetic Emission

964D0943B Nizhny Novgorod IZVESTIYA VUZOV: RADIOFIZIKA in Russian
Vol 38, No 3-4 Mar-Apr 95 pp 280-285

[Article by Ya. L. Bogomolov, N. S. Ginzburg and Ye. R. Golubyanikova, Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod; manuscript received 9 Feb 95; UDC 530.1]

[FBIS Summary] It is shown that incoherent pumping or a stochastic undulator can be used to improve the efficiency of a free-electron laser for beams with large dispersion of parameters (up to 30 percent) such as those formed by high-current injectors. This kind of pumping broadens the spectrum of Raman waves in step with the electron flux, giving rise to a mechanism of diffusion stochastic deceleration of beam particles. As a result, the effectiveness of transformation of beam energy to the energy of short-wave scattering of radiation is proportional to the width of the pumping spectrum, and may considerably exceed the values attained in the case of monochromatic pumping. And the effectiveness of transformation is practically independent of the width of the electron distribution function for translational velocities. Figures 3, formulas 8, references 5.

Russia: Stimulated Emission of Electromagnetic Waves by Josephson Vortices

964D0943C Nizhny Novgorod IZVESTIYA VUZOV: RADIOFIZIKA in Russian
Vol 38, No 3-4, Mar-Apr 95 pp 287-291

[Article by V. V. Kurin and A. V. Yulin, Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod; manuscript received 31 Jan 95; UDC 538.943]

[FBIS Summary] A new type of Josephson oscillator is proposed based on a principle of action similar to that of traveling-wave tubes. The device consists of a distributed Josephson contact coupled to a transmission line that acts as a decelerating system. As a result of the Cerenkov effect, waves are excited in the decelerating system by Josephson soliton vortices moving in the contact, and as they interact with the radiation field, these waves are grouped in the decelerating phase of the wave, ensuring coherence of the contribution of a large number of vortices to the radiation. The effect is called induced emission of electromagnetic waves by Josephson solitons. The authors analyze the linear stage of modulation instability in a chain of solitons moving in the contact. A quasistatic description is derived for

examining the soliton grouping process. The instability supports coherent operation of all solitons on the wave, converting their energy to intense microwave emission. Formulas 10, references 2.

Russia: Superradiation in Ensembles of Oscillator Electrons Under Conditions of Group Synchronism

964D0943D Nizhny Novgorod IZVESTIYA VUZOV: RADIOFIZIKA in Russian
Vol 38, No 3-4 Mar-Apr 95 pp 292-297

[Article by N. S. Ginzburg, I. V. Zotova and A. S. Sergeyev, Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod; manuscript received, 9 Feb 95; UDC 533.951.2]

[FBIS Summary] At the present time, considerable attention is being given to the study of induced radiation in spatially localized excited electron ensembles with infinite (in the radiation time scale) electron lifetime. It has been shown that self-organizing effects are appreciable under such conditions, resulting in phasing of electrons and subsequent coherent de-excitation of the stored energy in the form of short quasimonochromatic pulses. This process is called superradiation. In this paper the authors analyze the specifics of cyclotron superradiation under conditions of group synchronism, where the translational velocity of an electron bunch coincides with the group velocity of the electromagnetic wave. It is shown that the described mode increases the increment of superradiation instability and raises the peak power of emission. Estimates of pulse duration and the power of cyclotron superradiation in the mode of group synchronism yield values of the order of 10 RF oscillations and 40 MW. Figures 2, formulas 9, references 4.

Russia: Orientational Phase Conjugate Self-Reflection of Light Beam in Nematic Liquid Crystal Layer with Nonreciprocal Feedback

964D0943E Nizhny Novgorod IZVESTIYA VUZOV: RADIOFIZIKA in Russian
Vol 38, No 3-4, Mar-Apr 95 pp 304-311

[Article by O. L. Antipov, S. I. Belyayev and A. S. Kuzhelev, Institute of Applied Physics, Russian Academy of Sciences; manuscript received 10 Feb 95; UDC 548.0.537]

[FBIS Summary] The paper takes a look at parametric instability and self-pumped phase conjugation of a quasi-CW Nd:YAG laser with orientational induced scattering in a nematic liquid crystal layer with nonreciprocal feedback loop in which the pumping and scattering waves acquire various phase additives as they

propagate in opposite directions. The threshold of self-pumped phase conjugation in an arrangement with non-reciprocal feedback is studied based on the example of plane pumping waves. It is found that the threshold of parametric lasing depends on the temperature of the nematic liquid crystal: no self-pumped phase conjugate beam generation is observed when the temperature is raised to the nematic-isotropic liquid phase transition point. This is attributed to formation of a thermal lens in the liquid crystal layer. The authors thank the International Science Foundation for awarding grant NOK000, which was used in part to support this research. Figures 3, formulas 5, references 11.

Russia: Excitation of Ionospheric Alfvén Resonator by Plasma-Wave Discharge

964D0943F Nizhny Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian
Vol 38, No 3-4, Mar-Apr 95 pp 312-317

[Article by N. G. Lekhtinen, G. A. Markov and S. M. Faynshteyn, Nizhegorodskiy State University imeni N. I. Lobachevskiy; manuscript received 22 Jan 95; UDC 550.388.2]

[FBIS Summary] The paper gives experimental data on excitation of ELF oscillations in the ionosphere by a plasma-wave discharge from a weather rocket, and presents a simplified theoretical model that qualitatively explains the observed effect. The increment of generation of Alfvén waves is found, and excitation of the ionospheric Alfvén resonator is estimated. The theoretical conclusions agree with experiment. The work was done with support of the International Science Foundation (grant No R86000, No 88000) and the Universities of Russia program. Figure 1, formulas 12, references 12.

Russia: Experimental Observation of Slow and Stationary Solitons

964D0943G Nizhny Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian
Vol 38, No 3-4 Mar-Apr 95 pp 325-330

[Article by A. V. Vederko, V. F. Marchenko and A. P. Sukhorukov, Physics Department, Moscow State University imeni M. V. Lomonosov; manuscript received 31 UDC 537.86/87.532.59]

[FBIS Summary] Excitation of slow and stationary solitons is studied in a radiophysics model consisting of a chain of 30 coupled nonlinear tank circuits with coils placed tightly together, providing a coupling coefficient of $\kappa = M/L = 0.08$ ($L = 47.5 \mu\text{H}$ is inductance of the tank coil, M is mutual inductance). A frequency-dependent matched load was used to eliminate reflections from the

ends of the system. The measured SWR did not exceed 1.5 in the passband, and 2 near cutoff frequencies. The nonlinear tank component was a pair of reverse-biased semiconductor voltage regulators connected in opposition. The structure was essentially a band-pass filter with central frequency equal to the resonant frequency of an individual tank: 1131 kHz \pm 1 kHz, and cutoff frequencies of 1123 and 1040 kHz. An increase in input signal amplitude from 20 mV to 1.0 V lowers the lower cutoff frequency of such a system from 1040 to 1027 kHz, which is just the range where a stationary soliton may be observed. The experimental results are studied by using a model based on the nonlinear Schrödinger equation. The work was supported by the Russian Fundamental Research Foundation (project No 93-02-16059). Figures 4, formulas 3, references 7.

Russia: Bistability of Optical Solitons Produced in Nonlinear Interactions of Waves with Multiple Frequencies

964D0943H Nizhny Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian
Vol 38, No 3-4 Mar-Apr 95 pp 331-336

[Article by M. V. Komissarova and A. P. Sukhorukov, Physics Department of Moscow State University imeni M. V. Lomonosov; manuscript received 30 Jan 95; UDC 621.373.826]

[FBIS Summary] The authors give the first analytical demonstration of the possibility of existence of optical bistable envelope solitons formed on multiple frequencies in a medium with square-law nonlinearity. Numerical estimates of amplitude ratios are given. Figure 1, formulas 10, references 10.

Russia: Experimental Study of Spatial Distribution of Intensity of Cavitation Processes

964D0943I Nizhny Novgorod IZVESTIYA VUZOV:
RADIOFIZIKA in Russian
Vol 38, No 3-4 Mar-Apr 95 pp 337-341

[Article by L. M. Kustov, V. V. Lebedev and A. I. Martyanov, Nizhegorodskiy State University; manuscript received 1 Feb 95; UDC 532.528]

[FBIS Summary] The authors propose a method of non-contact measurement of spatial distribution of intensity of cavitation processes in flow past rigid surfaces. High spatial resolution is achieved by using a system that produces an image of the source in acoustic waves. Focusing is by a rigid spherical mirror with aperture of 15 cm and focal length $F = 14$ cm. The experiment was done in a hydroacoustic tank. Cavitation noise was produced by flow past a cylinder and fine wires. The

work was done within the scope of RFRF grant No 94-05-16755. Figures 4, reference 1.

Russia: Experimental Study of Phenomenon of Mutual Localization of Field and Plasma on Antenna Operating in Corona-Forming Mode

964D0943J Nizhny Novgorod IZVESTIYA VUZOV: RADIOFIZIKA in Russian
Vol 38, No 3-4 Mar-Apr 95 pp 342-348

[Article by G. A. Markov and A. L. Umnov, Nizhgorodskiy State University imeni N. I. Lobachevskiy; manuscript received 3 Feb 95; UDC 533.951]

[FBIS Summary] An experimental study of the nature of self-coordinated distribution of RF plasma and the radial electric field that produces it in space near a dipole of finite dimensions operating in a rarefied gas in the corona-forming mode. The results of the experiment show that discharge formation near the end of the antenna changes the current over the entire radiator. On the antenna section that is free of plasma, the current distribution is more level than in the linear mode, and there is an abrupt drop in current amplitude inside the corona. The shape of the current on most of this section is apparently near-linear. The maximum current may either increase or decrease when the antenna goes into the corona-forming mode, depending on the initial tuning of the antenna by the tank circuit at the input. The nature of the transient process in the antenna-corona system in which the forming plasma changes the near field of the antenna, which in turn modifies the parameters of the corona, suggests an effect of mutual localization of field and plasma. The work was done with support of the Soros International Science Foundation, grant No RR6000, and RFRF grant No 95-02-05816a. Figures 2, references 7.

Russia: Biomarkers of Ciscaucasian Oils

964D0948A Moscow NEFTEKHIMIYA in Russian
Vol 35 No 4, Jul-Aug 95 pp 291-310

[Article by N. S. Vorobyeva, Z. K. Zemakova, G. V. Rusinova and A. A. Petrov, Institute of Geology and Development of Mineral Fuels, RF Ministry of Fuel and Energy and Russian Academy of Sciences, Moscow; manuscript received 20 Apr 95; UDC 550.4:552.578.2(571.1)]

[FBIS Summary] Higher cyclic biomarkers (steranes, tri-, tetra- and pentacyclic terpanes) of Ciscaucasian oils are studied by methods of computerized chromatomass spectrometry. The investigated oils cover the entire productive stratigraphic range of deposits from the Neogene to the Triassic. Based on the results, the authors deduce conditions of generation of the oils,

and the composition of the original organic material. It is noted that oils in Triassic and Jurassic deposits are catagenetically strongly transformed (the biomarker concentration is insignificant). Oils in Upper Cretaceous deposits of the platform region of the Caucasus, as well as oils of Cenozoic deposits of the Teriko-Surhen zone are catagenetically mature with a greater concentration of biomarkers; the Cenozoic oils of the West Kuban downwarp are catagenetically less mature. The research was funded by International Science Foundation grant No 5A000. Figures 5, tables 4, references 7.

Russia: Thermodynamic Indices of Iron-Containing Catalysts and Kinetics of Hydrogenation of High-Viscosity Karazhambas Oil

964D0948B Moscow NEFTEKHIMIYA in Russian
Vol 35, No 4, Jul-Aug 95 pp 351-358

[Article by A. T. Ordabayeva, M. I. Baykenov, V. A. Khrupov, A. Ya. Chen, K. M. Mamrayeva, B. K. Kasenov and B. T. Yermaganbetov, Institute of Organic Synthesis and Coal Chemistry, Karaganda; manuscript received 19 Sep 94; UDC 541.11:662.749]

[FBIS Summary] Pyrite is treated in an autoclave with the use of various reducing atmospheres (CO , CO/H_2 , $\text{CO/H}_2\text{O}$) at 673 K and initial gas pressure of 4.0 MPa. Equations are derived for the temperature dependence of specific heat, and thermodynamic functions $S^\circ(T)$, $H^\circ(T)$, $-H^\circ(298.15)$ and $\Phi^\circ(T)$ of pyrrhotites are calculated. The Gibbs free energy, enthalpy, entropy and equilibrium constant of reduction of pyrite are determined. The authors study the kinetics of hydrogenation of high-viscosity oil of the Karazhambas field (Republic of Kazakhstan) in the presence of pyrite. The effective values of reaction rate coefficients and apparent activation energies are determined. The results show that energy hindrance is minimum for processes of destruction of the organic mass of high-viscosity oil with formation of light and medium fractions. Therefore the process temperature should be kept low to get white fractions. Figures 3, tables 4, formulas 16, references 15.

Russia: Joint Adjustment of General Government Reference Geodesic Networks

964D0750A Moscow GEODEZIYA I KARTOGRAFIYA in Russian Aug 95 No 8, pp 6-17

[Article by N. A. Bovshin, V. I. Zubitskiy, O. M. Ostach; UDC 528.3:528.14]

[FBIS Summary] The territory of Russia currently has three geodesic networks that are comparable in accuracy, the astronomic-geodesic network, the space geodesic network, and the Doppler geodesic network.

(which uses the American TRANSIT navigational satellite system for measurements). In order to unite them into a single geodesic network, combined adjustment of the three geodesic networks was done simultaneously with a determination of the parameters of transition between the coordinates systems that the networks implement. The procedure used in constructing each of the initial geodesic networks are described. The general mathematical method used for joint adjustment of the systems is presented. The SOVURA program, a FORTRAN program to carry out the joint adjustment of independent geodesic networks, is described. The program uses the algorithm described in the paper. The main result of the adjustment was coordinates of points in the unified network in a zero-solution system of coordinates as well as a covariational matrix of coordinate errors. The data and names of points are cataloged in an external file in the same format as the initial network. The issue of coordinate conversions is discussed. The specific case of Sakhalin is discussed. Coordinate conversions are cataloged in a separate file, as well as deviations. Tables 3; references 2 (Russian).

Russia: Development of Research Program for Utilizing Russia's Underground Space

964D0940A Moscow GORNYI ZHURNAL in Russian
Oct 95 No 10, pp 30-32

[Article by B. A. Kartozhiya, academician, Academy of Natural Sciences, MGGU; UDC 622.016.001.5(470)]

[FBIS Summary] The author considers development of a program for maximizing the use of natural and man-made cavities of the earth's interior on Russian territory to accommodate facilities that provide various kinds of functional life support for human society: economic, social, ecological and defense. It is proposed that such a program should be carried out in the following areas: a governmental plan for using underground space to site facilities with various national economic purposes, making allowance for effective use and protection of the environment; geomechanical principles of designing, building and using underground structures for planned assimilation of underground space; investigation of hydrodynamic, thermal and aerodynamic processes in the system comprising underground spaces and the surrounding rocks; investigation of ecological processes in the system that includes underground space and man; substantiation and development of engineering and technological approaches to the use of underground space. References 7.

Russia: Status and Outlook for Development of the Gold Mining Industry of the Russian Federation

964D0938A Moscow GORNYI ZHURNAL in Russian
Nov 95 No 11, pp 8-10

[Article by V. P. Gritsayev, deputy chairman of RF Committee for Precious Metals and Precious Stones, chief of Roszoloto Administration, candidate of technical sciences; UDC 622.342.1(470)]

[FBIS Summary] The authors review the current status of the gold mining industry of the Russian Federation and look at its future. In terms of volume, the industry has remained fairly stable in recent years: 1992—125.9 metric tons, 1993—136.0 m.t., 1994—131.9 m.t. The largest gold mining regions are the Republic of Sakha (Yakutia), Magadan, Amur and Irkutsk Oblasts, and Chukchi National District. The effectiveness of placer gold recovery has declined drastically in recent years, and other problems have arisen due to breakdown of ties between industries and between republics, deterioration of logistics, loss of funding and investments, disruptions of transportation in the Far North, and deterioration of socioeconomic conditions. The comparatively stable performance of the precious metals industry over the last three years has been helpful in implementation of economic and organizational measures aimed at consolidating economic reform in the industry and attracting the interest of outlying regions in increasing gold mining. To maintain the gold production level that has been reached and to further develop the industry, the RF Committee for Precious Metals and Precious Stones has proposed the draft of a Federal Program of Gold and Silver Production in Russia for 1994-1995 and for the Period up to the Year 2000, calling for constructing 21 new gold mining enterprises with total mining and refining capacity of 17.3 million m.t. of ore, and rebuilding seven existing enterprises with an increase in their capacity by 3.2 million m.t. of ore. The main problem in carrying out the program is to find investment funding.

Russia: Geological Structure of Paleozoic Sediments of the Caspian Ridge and East Manych Depression and Oil and Gas Potential

964D0801A Moscow RAZVEDKA I OKHRANA NEDR
in Russian Nov 95 No 11, pp 24-27

[Article by A. V. Bembyev, V. E. Bembyev, Kalmnedra State Geological Enterprise, Kalmneokom]

[FBIS Summary] The central and southern regions of the Republic of Kalmykia are in the Northern Caspian-Mangyshlak oil and gas region in the north of the Epiherzen platform. There are four lithological-stratigraphic oil and gas complexes. This paper examines the Triassic-Carbonaceous oil and gas complex. Its

deep structure and geological history are outlined. It is estimated that the northern border of the East Manych depression alone should contain 48.1 million tons of oil, not considering that the thickest part of the Triassic deposit is at the Caspian ridge itself. Initial total resources are estimated to be 400 million tons of ideal fuel, comprised of 200 million tons of oil and condensate, and 200 billion cubic meters of gas. Figures can be refined by drilling parametric wells up to 6 km deep. References 8 (Russian).

Russia: Change in Microstructure of Dusty Loams with Formation of Seismogenic Mudslides

964D0954A Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: GEOLOGIYA in Russian No 6, Nov-Dec 95 pp 67-73

[Article by O. V. Zerkal and V. N. Sokolov; manuscript received 14 Sep 93; UDC 624.131+624.131.543]

[FBIS Summary] To determine the possible influence that soil microstructure has on mudslides, the authors study the morphometric and geometric features of the structure of loesses, and their changes during formation and development of the catastrophic seismogenic mudslides accompanying the Gissar earthquake that occurred on 23 January 1989, 17 km southwest of Dushanbe (Tajikistan). It is shown that during the formation and development of seismogenic mudflows in loess rocks, the microstructure of loesses undergoes a transformation that reflects the mechanism of deformations. The primary granular (laminar dust, aggregate grain) microstructure of saggy dusty loams in heavily strained form is retained only as isolated aggregates of moderately fine-sand dimensions. The most profound changes of microstructure are noted in the lower part of mudflow tongues, where soils have an inherently pseudocellular microstructure. Investigation of the microstructure of mudflow deposits confirms the assumption of the major role of thixotropic fluidizing of loesses during seismic action in the formation of seismogenic mudslides. It is found that in the lower part of the slide, shifting occurs as displacement of the heavily waterlogged soil mass, whereas in the middle and upper parts of the slide with decreasing moisture content, motion takes place by sliding of individual aggregates and coarse grains relative to one another. Figures 5, references 4.

Russia: Radionuclides in West Arctic Seas

964D0952A Moscow IZVESTIYA ROSSIYSKOY AKADEMII NAUK: SERIYA GEOGRAFICHESKAYA in Russian No 6, Nov-Dec 95 pp 36-42

[Article by G. G. Matishov, D. G. Matishov, L. G. Pavlova, Murmansk Marine Biological Institute, Rus-

sian Academy of Sciences, K. Rissanen, Radiation and Nuclear Safety Center, Finland, and J. Szczypa, Lublin University, Poland; manuscript received 7 Feb 95; UDC 574.4:504.054(268.45+268.52)]

[FBIS Summary] Information about the amount of radionuclides in sea water, bottom deposits, plankton, bottom fauna, macrophytes, fish, birds, and marine mammals of the Kara and Barents Seas has been limited until now. In this connection, an analysis is made of extensive factual material acquired on expeditions of the Murmansk Marine Biological Institute in the Western Arctic in 1990-1994. Also systematized are accessible published and deposited materials on radionuclides on the Kola Peninsula, Novaya Zemlya, Franz Josef Land and the Arctic Sea shelf. The purpose of the work was to evaluate the level and ascertain the patterns of distribution of radionuclides in the sea at the present stage, to determine oceanological phenomena that are conducive to self-purification of the marine environment, and to locate sources of radioactive contamination of the ecosystems of the shelf and littoral of the Barents and Kara Seas. It was learned that isotopes of cesium, strontium, plutonium, americium and cobalt come chiefly from the old nuclear proving grounds of Novaya Zemlya and radioactive wastes of West Siberian rivers. Radioactive waste dumpsites are of secondary significance. In the total balance of radionuclides of the West Arctic basin in the seventies and eighties, a major role was played by runoff of radioactive wastes from Sellafield plants. However, their influence was limited by regions of penetration of Atlantic waters of the Gulf Stream onto the shelf. The content of radionuclides in the natural environment of the Barents and Kara Seas corresponds basically to the natural background. However, high levels of accumulation of man-made radionuclides are encountered that are due to the specifics of the wind rose, the directions of currents, and river runoff. For example, the average concentration of ^{137}Cs in lichens of Murmansk Oblast is 250 Bq/kg, the minimum is 70, and the maximum for lichens on the Kola Peninsula is about 800 Bq/kg of dry weight. But in lichens collected near the point where nuclear tests were conducted (on Vaygach Island, in the southern and western parts of the islands of Novaya Zemlya and Naryan-Mare), the cesium level did not exceed 30-150 Bq/kg. The radioactivity of bottom sediments of the Barents, Pechora and Kara Seas is low. The concentration of ^{137}Cs in bottom deposits, depending on type of sediments, ranges from 0.1-10 to 20 Bq/kg. Isolated bays and inlets are an exception, as well as the trench of the shelf, where sediments contain from 30-40 to 80-100 Bq/kg of ^{137}Cs . Maximum levels of radionuclides are typical of deposits near the old nuclear test sites of Novaya Zemlya. The ^{60}Co observed in bottom deposits of the Yenisey Gulf and Stepovoy Bay

(2-6 Bq/kg) indicate regional leaks of nuclides at sites of nuclear waste storage. Live organisms of the Barents-Kara shelf contain relatively little ^{137}Cs from 0.1-0.8 to 1-4 Bq/kg. Polychaeta show some tendency to accumulate ^{137}Cs and ^{60}Co due to their feeding habits. The research results show that continual monitoring of the radiation environment should be set up in the area, and should not only be based on conventional determination of parameters of abiotic components of the ecosystem such as soil and water, but should also be extended to as many biological objects as possible, especially those that are concentrators of radionuclides and that enter into trophic chains. Table 1, references 17.

Russia: Mapping Dynamics of Desertification of Lands from Repeated Aerial and Satellite Imaging

964D1006A Moscow IZVESTIYA AKADEMII NAUK: SERIYA GEOGRAFICHESKAYA in Russian
No 2, Mar-Apr 96 pp 131-140

[Article by B. V. Vinogradov, K. N. Kulik, Institute of Problems of Ecology and Evolution, Russian Academy of Sciences; All-Russian Institute of Agriculture, Forestry and Land Reclamation, Russian Agricultural Academy; UDC 531.3:574.9]

[FBIS Summary] The authors look at the experience of regional mapping of the long-term dynamics of desertification and degradation of lands of Kalmykia from aerial and satellite images of 1954-1984 and 1954-1993. From the index of change in the area of moving sands and wind eroded surfaces as measured on these images, isolines are plotted by the Surfer applied software package for the increment of their area with interval of 100 ha/yr/pixel. The use of such isoline maps of the dynamic pattern enables computation of areas of very strong, strong to moderate, and weak desertification, and absence of desertification within the limits of regions in accordance with the investigated index. Figures 5, tables 2, references 15.

Russia: Using Research Ships in Geological Prospecting in Polar Sea Geological Prospecting Expedition

946D0951A Moscow RAZVEDKA I OKHRANA NEDR in Russian Dec 95 No 12, pp 19-22

[Article by V. D. Kryukov and M. N. Maslov, GP "PMGRE"]

[FBIS Summary] The Polar Sea Geological Prospecting Expedition (PMGRE [Polyarnaya morskaya geologorazvedochnaya ekspeditsiya]) began leasing ships for research on seas and in the great oceans in 1969, long before acquiring its own research ships. In June of 1984, GP PMGRE got its first research ship, the "Academician

Aleksandr Karpinskiy," with displacement of 5600 metric tons. This vessel was originally used for prospecting work in the Central Pacific, taking large samples of iron-manganese nodules, massing a total of about 350 metric tons. Six voyages lasting from 120 to 180 days were made from 1984 through 1989. After completing this project, the ship was refitted for comprehensive geophysical studies, focusing mainly on marine seismic research. In 1985, PMGRE started working on the problem of hydrothermal mixed metal sulfides (HMMS) as a promising form of mineral raw material. The new research ship "Geologist Fersman" was used for this research in axial sections of rift zones of the ocean. The first phase was carried out in the vicinities of the East Pacific Rise and the Mid Atlantic Ridge, where published data indicated there were ore bodies. The second phase, starting in 1987, involved mapping of these regions on a scale of 1:500,000 to find promising sections for locating HMMS, where detailing substations were set up for regional work on scales of 1:100,000 and 1:250,000. This work provided data on the chemical and mineralogical composition of HMMS, as well as large samples ranging in mass from hundreds of kg to 1 metric ton for studying the technological properties of the ores. Promising sections in both regions have been singled out for the third phase: exploration. In 1991, GP PMGRE acquired a new specialized research ship, the "Professor Logachev." The new vessel will enable detailed HMMS exploration on scales of 1:50,000-1:5,000 with error in the low tens of meters. Economic problems have forced PMGRE to curtail operations in the Pacific, and therefore all HMMS work has been transferred to the Atlantic, and even at that the volume has been reduced. The paper summarizes the work that has been accomplished to date.

Russia: Hardware and Technology Requirements for Marine Geological Exploration

946D0951B Moscow RAZVEDKA I OKHRANA NEDR in Russian Dec 95 No 12, pp 30-32

[Article by I. F. Glumov, RF State Committee for Geology and the Use of Mineral Resources, V. A. Kulyndyshev, Okeanogeofizika Scientific Research and Planning Institute, Yu. I. Matveyev, and Ye. D. Dvitsain, Sevmorgeo]

[FBIS Summary] The geological requirements are given for development of new hardware and technologies in accordance with "Main Provisions of Federal Program for Development of the Raw Materials and Supply Base of the Russian Federation for 1994-2000" with regard to geological investigation of the mineral wealth of the Russian Federation, the continental shelf, and the great

oceans. Basic physical parameters for specific tasks and geographic areas are listed in four areas:

1. geological-geophysical and geological-survey work on the continental shelf;
2. development of a state network of reference geophysical profiles;
3. geological-engineering and geocological surveys, and monitoring of the geological environment;
4. investigation of potential commercial minerals.

Russia: Radiogeodetic and Radionavigational Aids in Marine Geology

946D0951C Moscow RAZVEDKA I OKHRANA NEDR in Russian Dec 95 No 12, pp 33-35

[Article by M. A. Agafonnikov and N. A. Yaroslavtsev Okeanogeofizika Scientific Research and Planning Institute]

[FBIS Summary] A review of the use of electronic geodetic and navigational aids in marine geology. The first radiogeodetic system (RGS) used in marine geological and geophysical research was the Koordinator-S phase RGS deployed in the Caspian in the fifties. This system was plagued by problems of poor transportability, complexity and high operating costs. Efforts to overcome these drawbacks resulted in the Poisk phase RGS for marine and aerogeophysical research, which has remained the basic bridging aid for work on the continental shelf. In 1970, the unattended self-contained miniature high-economy Poisk-ATM phase RGS was developed, successfully tested, and intensively used in the Black and Berents Seas. In response to expansion of the geography of marine geological and geophysical research in the late seventies and early eighties, a digital responder was developed for the Loran-S long-range pulse-phase radionavigational system that was used as a navigational aid in research in the Mediterranean, North Atlantic, the Far East, and the Bering Sea. By that time, computers were being used for upgrading existing systems and developing new ones. The increase in scale of geological and geophysical surveys to 1:100,000 in the great oceans, and the advent of low-orbit satellite radionavigational systems prompted the development of precision navigational and geodetic systems, ultimately leading in 1975-1980 to the "Mars" automated navigational-geophysical package: a multi-processor computational system designed around two YeS-1010 minicomputers, which became the basis of an integrated navigational system. Optimum static filters provided real-time processing of information entering the system from navigational sensors, enabling round-the-clock bridging of the points of geophysical

observations. The next step in development of electronic navigational and geodetic aids will be a self-contained responder-course plotter with the capability of input of an electronic map, recording the traversed path and hydrographic information.

Russia: Algorithm and Control System of Towed Seismograph

946D0951D Moscow RAZVEDKA I OKHRANA NEDR in Russian Dec 95 No 12, pp 37-39

[Article by B. A. Bondarenko, RF State Committee for Geology and the Use of Mineral Resources, N. V. Belyayev, and V. Ye. Kudryashov, St. Petersburg GETU]

[FBIS Summary] Modern marine seismic research facilities provide for the use of towed seismic detector cables (SDC) with digital electronic components. These may reach a length of 12 km or more. Analysis of measurement errors of navigational aids used in towing these long SDCs shows that special algorithms and software are needed to get the required accuracy of determining SDC coordinates in detailed seismic research. The authors propose algorithms for filtering, calculating the current position of the towed SDC, predicting its motion, generating the required program for motion of the ship and towed devices, and output of recommendations to the operator for controlling depth stabilizers. Formulas 20.

Russia: Experiment In Electric Sounding of the Upper Mantle of the Urals with the Field of the Traction Network of an Electrified Railway

964D0799A Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian Dec 95 Vol 36 No 12, pp 122-127

[Article by V. S. Vishnev, A. G. Dyakonova, O. A. Khachay; (manuscript received 15 Jul 93; after revision 28 Nov 94); UDC 550.837]

[FBIS Summary] Electrified railways can greatly distort geological data obtained using electric sounding methods. However, the electromagnetic field of a traction electrified railway can be used for geoelectric area mapping of horizontal inhomogeneities. Signals of the pulse field of electrified railways can be transformed into curves of apparent resistance ρ_a to determine the vertical geoelectric profile in a one-dimensional model of the medium. This paper extends this method by developing and using the Tyumen-Yekaterinburg line to study the conducting friable sediments of the eastern part of the Urals Paleozoic geosyncline. A method is developed to process and quantitatively interpret the data. An algorithm is presented. It can be used for approximate evaluation of longitudinal conductivity of friable sediments

under field conditions. The proposed method makes it possible to determine the geoelectric parameters of the medium in industrial regions with a developed electrified railway network. Results are compared with results obtained using magnetotelluric sounding methods. The method can yield information on the geoelectric structure of upper layers of the crust to depths of 3 km or more when the friable sediments are on a poorly conducting foundation. Figures 3; references 12 (Russian).

Russia: Analysis and Development of Relaxation Models of Dielectric Properties of Water for Remote Sensing Problems

964D0972A Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 6, Nov-Dec 95 pp 18-27

[Article by Ye. A. Sharkov, Space Research Institute, Russian Academy of Sciences, Moscow; manuscript received 30 Mar 95; UDC 551.46:528.85]

[FBIS Summary] It is shown that approximation formulas describing the temperature behavior of the static constant and relaxation wavelength in existing models correspond satisfactorily both to each other and to the values of parameters obtained by processing. On the other hand, the state of affairs with regard to existing approximations of the "optical" constant is found to be unsatisfactory to the point of qualitative differences. The physical reasons for these discrepancies are discussed, and experimental ways to resolve the problem are indicated. Figures 5, table 1, formulas 8, references 30.

Russia: Combined Aerospace Probing in Developing and Operating Geotechnical Systems

964D0972B Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 6, Nov-Dec 95 pp 67-81

[Article by V. P. Savinykh, A. S. Viktorov, Yu. P. Kiyenko, A. L. Revzon, A. V. Sadov, S. P. Skobelev and B. V. Shilin, Moscow State University of Geodesy and Cartography; Priroda State Center, Moscow; Aerotryskaniye Scientific Production Center, Moscow; All-Russian Scientific Research Institute of Satellite Aerological Methods, St. Petersburg; Geological Institute, Russian Academy of Sciences, Moscow; Scientific Research Geoinformation Center, Russian Academy of Sciences, Moscow; manuscript received 29 May 95; UDC 528.91:629.78]

[FBIS Summary] The paper generalizes scientific developments and experience in introducing a new and promising area of aerospace probing of the earth as applied to solution of problems in siting, building and operating engineering structures under a variety of natural conditions. It is shown that a combination of technological methods of aerospace probing reduces geotechnical

risk in the system of building and operating engineering structures under conditions of high-rate occurrence of dangerous processes. Tables 4, references 8.

Russia: Geographic Information Support as a Decisive Factor in Developing Satellite Systems for Studying the Earth

964D0972C Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 6, Nov-Dec 95 pp 104-112

[Article by V. V. Lebedev, Geographic Information Center, Russian Academy of Sciences, Moscow; manuscript received 20 Feb 95; UDC 528.85:681.3]

[FBIS Summary] The author points out the necessity of acquisition, sorting and storage of satellite data in conjunction with ground-based materials for expeditiously and comprehensively using such information, which brings to the fore the problem of geographic information support of outlying regions. It is stated that a major factor in solving these problems should be setting up regional geographic information systems as nuclei of an information environment. Figures 4.

Russia: Accounting for Clouds in Satellite Remote Sensing of Pulsed Self-Luminous Objects on the Ground: 2. Detection and Ranging of Radiation Source Under Cloud Cover from Satellite Data

964D0971A Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 2, Mar-Apr 96 pp 18-24

[Article by V. V. Bacherikov, A. V. Fabrikov and O. I. Aldoshina, Science Center of Optical-Physical Research, Moscow; manuscript received 2 Aug 95; UDC 551.521:551.501:631.136:629.78]

[FBIS Summary] The authors formulate the problem of detecting and ranging of a cloud-covered source of radiation by a hyperbolic ranging method, using a network of satellite instruments. Perturbing terms in the equations for coordinates of the source are computed as applied to an isotropic cloud-obscured source of light pulses, using an analytical model of the signal path constructed by the authors. The generalized (total) least squares method is used for developing the mathematics of solving the problem with terms added to account for the distorting influence of a cloud layer with unknown parameters that are treated as additive noise. Numerical experiments confirm the applicability of this approach to the problem of determining the coordinates of a light source on the ground from satellite observations through clouds. Formulas 27, references 9.

Russia: Influence of Image Contrast on Interpreting Satellite Photos

964D0971B Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 2, Mar-Apr 96 pp 57-62

[Article by L. N. Aksyutov, Scientific Research Institute of Comprehensive Tests of Optoelectronic Devices and Systems, Sosnovyy Bor, Leningrad Oblast; manuscript received 24 Mar 95; UDC 618.3:771.64]

[FBIS Summary] Based on analysis of experimental data about the effect that contrast has on perception of visual stimuli in the context of a model of predicting visual pattern recognition from images, the author derives a formula for the relation between the perceived resolution of an image at contrast $K > 0.1$ and the operational threshold of recognition of categorical classification of an object represented by the figure of the image for various levels of information content. Tables 2, formulas 8, references 13.

Russia: Experimental Study of Methods of Optoelectronic Satellite Image Compression

964D0971C Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 2, Mar-Apr 96 pp 63-68

[Article by P. G. Darakhvelidze; Military Engineering-Space Academy imeni A. F. Mozhayskiy, St. Petersburg; manuscript received 11 Jul 95; UDC 681.382.2]

[FBIS Summary] The paper is devoted to a comparative analysis of the possibilities of transformational, wavelet and fractal methods of image compression as applied to the procedure of transmitting optoelectronic satellite images. It is found that transformational coding has inherent distortions of a block effect that shows up at a compression factor of 8-10 or more, as well as periodic structures that show up within blocks. Wavelet coding is typified by artifacts that show up in low-contrast regions. Distortions in fractal compression take the form of image smearing that may result in shape distortion or wipeout in low-contrast areas. Currently, only fractal compression permits prior assignment of the compression factor. It will be necessary to introduce feedback components that control quantization to give the other coding methods this feature. The transformational method has the widest range of compression factors: from 1.5 to as high as 40 in some cases. The other two methods have a range of 5-20, and image quality is considerably degraded at the maximum compression factor. The advantages of using a given technique depend on the correlation properties of the image. Figures 2, table 1, references 9.

Russia: Using Almaz-1 Satellite SAR Images to Study Field Crops

964D0971D Moscow ISSLEDOVANIYE ZEMLI IZ KOSMOSA in Russian No 2, Mar-Apr 96 pp 106-110

[Article by V. R. Zablotskiy, Russian Institute of Monitoring Lands and Ecosystems; manuscript received 22 Aug 95; UDC 528.873.044.1]

[FBIS Summary] The author looks at the feasibility of using Almaz-1 satellite SAR images to interpret field crops and to solve problems involving evaluation of crop status, based on high-resolution imaging data acquired in spring and early summer for an experimental farm in Krasnodar Kray. It is found that for these vegetative periods, it is possible to distinguish three major types of tilled and untilled crops, and bare soil. Within the class of untilled crops, subclasses of perennial grasses and winter grains can be distinguished by using a sequence of radar images for different seasons. The dynamics of accumulation of phytomass of winter wheat can be traced on images acquired in different vegetative periods. Low-phosphorus problems can be detected. Noise-suppression processing with learning is investigated. Figures 3, references 6.

Russia: Comprehensive Hydrochemical and Biochemical Studies of the Volga-Caspian Expedition on the Research Vessel Antares and GS-194 (4 Aug-10 Sep 95)

964D0800A Moscow OKEANOLOGIYA in Russian Vol 36 No 1, Jan-Feb 96 pp 148-151

[Article by V. V. Sapozhnikov, All-Russian Institute of the Fishing Industry and Oceanography, Moscow; (manuscript received 13 Oct 95); UDC 551.465]

[FBIS Summary] The need for new hydrochemical data for the Caspian Sea is especially urgent due to the recent increase in the level of the Caspian Sea, the increase in pollution, the development of eutrophic processes, and widespread oil and gas exploration operations. Test drilling of wells has already begun in some areas and there are no reliable benchmark data on the ecosystem. A key to the processes occurring in the Caspian Sea is the Volga reservoir system. Comprehensive studies encompassed the area from the Ivankovsk reservoir to the water divider at the head of the Volga delta above Astrakhan. Vertical sampling of temperature, salinity, dissolved oxygen, pH, and phytoplankton were taken. The size and quantity of mesoplankton (0.3-10 mm) were measured. The device used for the plankton study is described. The concentration of nitrites, nitrates, phosphates, silicon, total nitrogen, and phosphorus were measured, as well as ammonia and urea

The redox potential was determined. Protein, lipid, carbohydrate and nucleic acid content was measured, as well as chlorophyll a, b, and c, pheophytin, and carotenoids. Samples were tested for petroleum hydrocarbons, chlororganic pesticides, and heavy metals. The concentration of organic matter in the Caspian is rather high (about 2-3 times higher than in the Black Sea). Photosynthesis is limited by low nonorganic phosphorus levels, but occurs due to recycling of phosphorus in phospholysis. Lipid and protein content and primary products are discussed. Hypoxia was found in a thin bottom layer of water even in shallow regions 15-25 m deep. The influence of southeast prevailing winds is noted. General conclusions about the climatic situation are presented. Figure 1; reference 1 (Russian).

Russia: Resonant Sound Absorbers in Aqueous Media

964D1004A Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA FIZIKA, ASTRONOMIYA in Russian No 1, Jan Feb 96 pp 53-57

[Article by K. A. Pestov, A. G. Samokhin and O. S. Tonakanov (deceased), acoustics department; manuscript received 29 May 95; UDC 534.26]

[FBIS Summary] Based on the general theory of resonant sound absorbers (RSAs), an estimate is made of the possibility of using them in aqueous media. The authors show that it is feasible in practice to make RSAs for frequencies as high as 10 kHz by conventional methods. On higher frequencies, because the holes in the RSA panels are so small, conventional methods fail, and the hope is that it may be possible to use filled frame systems with fine pores. Figures 3, table 1, formulas 6, references 7.

Russia: Quantitative Interpretation of Satellite Geophysical Data

964D0953A Moscow FIZIKA ZEMLI in Russian Mar 96 No 3, pp 26-31

[Article by A. A. Bulychev, A. G. Gaynanov, D. A. Gilod, L. A. Zolotaya, Ye. L. Mazo, T. P. Fedorova, N. A. Chuykova and S. A. Kazaryan, Moscow State University imeni M. V. Lomonosov, Geology Department, Moscow, State Astronomy Institute imeni P. K. Shernberg, Moscow; manuscript received 13 Jan 95; UDC 550.831.015:528.7]

[FBIS Summary] Anomalies of the geoid are calculated for the region of the Mid-Atlantic Ridge in the vicinity of the Angola-Brazil geotraverse from satellite altimetry observations in Bouguer, Glenny and isostatic reductions with consideration of corrections for water mass, bottom topography in the three-dimensional version, and

depthwise density inhomogeneities, in accordance with data of seismic tomography. Glenny geoidal anomalies obtained after excluding the influence of depthwise density inhomogeneities agree nicely with the anomalies calculated from density models of the lithosphere in the rift zone of the Mid Atlantic Ridge. In accordance with MAGSAT satellite data, an extensive positive satellite anomaly of the Z component can be singled out over the territory of the East Siberian Platform that correlates with a region of development of a traprock complex of the Tunguska depression. The authors calculate the direct effect of plateau basalts and the intrusive complex in the three-dimensional version, and it is shown that the effect of this part of the section at the satellite altitude (400 km) is 4 nT, which is equal to half the amplitude of the satellite magnetic anomaly. The work was done with financial support of the Russian Fundamental Research Foundation (code 93-05-8740). Figures 3, formulas 7, references 29.

Russia: Pattern of Relation Between Focal Mechanisms of Earthquakes and Geological Structure of Regions

964D0953B Moscow FIZIKA ZEMLI in Russian Mar 96 No 3, pp 33-52

[Article by L. M. Balakina, A. I. Zakharova, A. G. Moskvina and L. S. Chepkunas, Joint Institute of Physics of the Earth imeni O. Yu. Shmidt, Russian Academy of Sciences, Moscow; manuscript received 30 Sep 95; UDC 550.348.2]

[FBIS Summary] The authors study the source mechanisms of 206 large crustal earthquakes of Northern Eurasia with comprehensive analysis of the entire body of initial data, including seismograms, substantiating selection of the focal mechanism solution with estimation of the accuracy of its parameters. Sources of errors in determinations are demonstrated by a number of examples. Solutions of the focal mechanisms are found for 179 earthquakes. Maps are plotted of the focal mechanisms, and of the orientation of axes of compression and dilatation in the foci. A clear pattern is found in the relationship between focal mechanisms of large earthquakes and the geological structure and type of tectonic movements in the investigated regions. With passage from one region to another, the focal mechanisms change in accordance with the change of geological conditions and type of tectonic movements. The parameters of reliably established source mechanisms enable more precise determination of the orientation of active geological faults and the type of movements along them in specific seismogenic zones, which is important in evaluating the seismic danger of the corresponding territories. Figures 8, tables 2, references 30.

Russia: Effect of Change in High-Frequency Part of Spectrum During Earthquakes with Foreshocks964D0953C *Moscow FIZIKA ZEMLI in Russian*
Mar 96 No 3, pp 91-96

[Article by G. V. Dubrovina and G. A. Sobolev, Institute of Seismology, Joint Institute of Physics of the Earth imeni O. Yu. Schmidt, Russian Academy of Science, Moscow; manuscript received 30 Mar 94; UDC 550.348.098]

[FBIS Summary] The authors analyze the spectra of strong earthquakes of similar magnitudes ($M > 5.9$) with and without foreshocks for regions of the islands of Japan. Foreshock activity was considered in a broad sense where preceding tremors may occur several months before the main seismic event. The results of the study show that the higher-frequency spectrum of radiation of earthquakes with foreshocks may be associated with a shove over a rougher fault surface. This is a consequence either of more uniform structure of the earth's crust in the focus, or the absence of slow creep motion that smooths the fault when an earthquake is initiated by its foreshock. Nor can we rule out the non-linear effects of generation of high frequencies on an uneven and less than absolutely rigid fault surface under conditions of foreshock activity. Differences in radiation have to be taken into account when calculating seismic stimuli in problems of assessing seismic danger and earthquake-safe construction. Aftershocks of strong earthquakes can also be taken as initiated with respect to the main tremor. In this regard, observations should be made of the corresponding differences in spectra of main seismic events and their strongest aftershocks, as well as in the spectra of foreshocks and aftershocks of different magnitude. Figures 3, tables 2, references 8.**Ukraine: Seismic Method of Locating Offshore Gas Hydrates in the Black Sea**964D0936A *Kiev GEOFIZICHESKIY ZHURNAL in Russian* Vol 17 No 2, Mar-Apr 96 pp 70-76

[Article by A. F. Komornyy and A. I. Samsonov, Odessmorgeologiya State Geological Enterprise, Odessa, Ukraine; manuscript received 21 Jul 94; UDC 553.981(261)]

[FBIS Summary] Geological research has shown evidence of wide occurrence of offshore gas hydrates on the continental slope and in the deep water area of the Black Sea. Analysis of more than 5000 km of seismic time sections has shown that wave field anomalies typical of hydrate formation zones and sub-hydrate hydrocarbon reservoirs are widely prevalent in the Black Sea. As a result of studies by the authors, parameters have been generalized, and estimates have

been made of criteria for recognizing hydrate formation zones. Specific anomalous objects have been distinguished that are interpreted as large zones of hydrate formation, sub-hydrate hydrocarbon reservoirs and gas hydrate deposits. Further study by geological and geophysical methods is recommended. Figures 6, table 1, references 12.

Russia: Characteristics of Aerosols in Boundary Layer of Atmosphere Over Moscow964D0970A *Moscow FIZIKA ATMOSFERY I OKEANA in Russian*
Vol 32 No 2, Mar-Apr 96 pp 163-171

[Article by B. I. Ogorodnikov, A. K. Budyka, V. I. Skitovich and A. V. Brodovoy, Physicochemical Institute imeni L. Ya. Karpov; manuscript received 29 Apr 94, after revision 7 Jul 94; UDC 551.510.4]

[FBIS Summary] The paper gives the results of an experiment done in November-December 1992 on the Ostankino television tower, using fiber filters to get data about the concentration, elemental composition and size of aerosolic particles from ground level to an altitude of 400 m, and also to call the attention of researchers to the necessity of accounting for both the concentration and sizes of particles in the dynamics of atmospheric aerosols when classifying them. Simultaneous samples were taken by filter packets at four altitudes: 1, 47, 152 and 377 m. Twenty chemical elements were identified on the aerosolic particles, and vertical profiles were plotted for their concentrations and sizes. Analysis of correlation matrices of the concentrations of aerosols and comparison of the changes in particle sizes in the collected samples revealed seven groups of atmospheric aerosols characterized by identity of time and altitude behavior: 1—Ca, Al, Fe, Mo; 2—Ti, Mn; 3—Cu, Zn; 4—K; 5—Ni, V, Pb, Co; 6—Cd, Sb; 7—Sn, Hg, Cr. This suggests that there are seven sources of aerosols in the vicinity of the Ostankino tower that differ in physicochemical processes of formation. The authors thank associates of Moscow Central Hydrometeorological Station Yu. S. Osipov, A. V. Simkin and A. S. Shuterman, and engineers of Karpov Physicochemical Research Institute A. G. Sharapov and G. V. Kazartsev for assistance with organization and sample collection on the television tower in Ostankino. Figures 3, tables 4, formulas 2, references 21.

Russia: Laboratory Studies of Spatial Spectra of Radio Emission of Periodically Uneven Water Surface

964D0970B Moscow *FIZIKA ATMOSFERY I OKEANA in Russian*
Vol 32 No 2, Mar-Apr 96 pp 183-185

[Article by V. A. Ilin, V. G. Irsov and S. S. Kasyanov, Moscow Pedagogical State University; manuscript received 11 Jul 94, after revision 20 Sep 94; UDC 551.465.6:537.877]

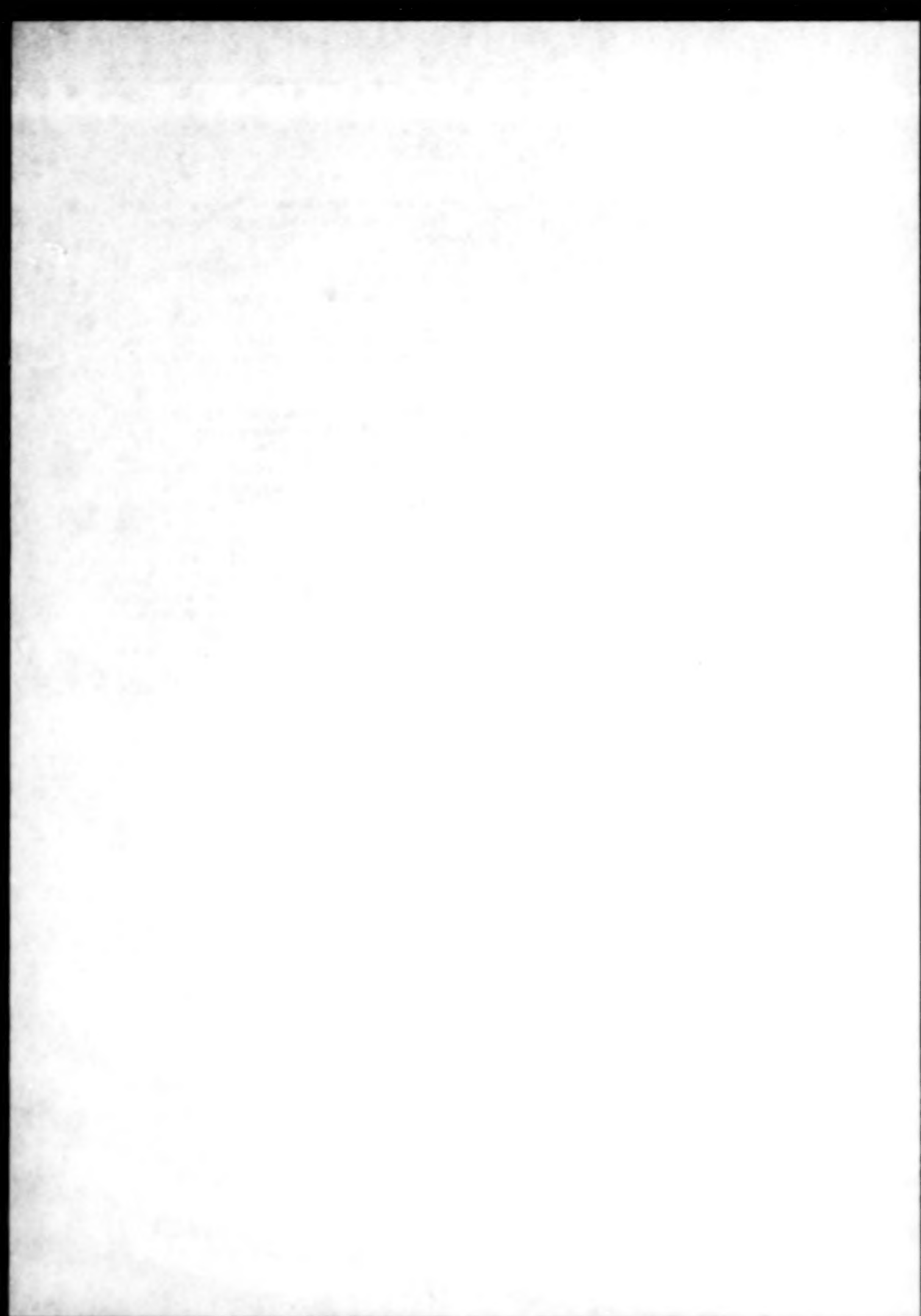
[FBIS Summary] Laboratory studies are done on the spectra of natural radiation of a periodically uneven water surface in the 8-mm wave band, and the resultant data are compared with calculations in the theory of critical phenomena. The experiments were done with an 8-mm Fourier spectrometer based on a wide-band Josephson detector radiometer. The path-length difference Δl was roughly quadrupled by filling the waveguide acting as one interferometer arm with distilled water, which has permittivity $\epsilon' \approx 18$ in the 8-mm band. This brought the resolution of the Fourier spectrometer to $\Delta f \approx 130$ MHz. The wave field was produced by a system of fine parallel nylon threads stretched on a rectangular frame immersed in a tank containing fresh water. Lifting the frame to the surface of the water set up a periodic structure with roughness dimensions Λ and amplitude a that could be varied. Spectral measurements were made in the frequency band of 25-43 GHz at sighting angles $\theta = 0^\circ$ - 8° from the nadir. Theoretically predicted resonance maxima of radiation intensity of diffraction nature were observed. Figures 3, formulas 3, references 11.

Russia: Lidar: Determination of Range of Visibility in Turbid Atmosphere Using Multiple Scattering Processes

964D0970C Moscow *FIZIKA ATMOSFERY I OKEANA in Russian*
Vol 32 No 2, Mar-Apr 96 pp 199-206

[Article by V. A. Korshunov, Tayfun Scientific Production Association; manuscript received 26 May 94, after revision 9 Sep 94; UDC 551.501.816:551.591]

[FBIS Summary] The author considers a lidar arrangement with extended base and detuning of the optical axis of the receivers away from the direction of the probing beam. Signals are described in a quasi-homogeneous approximation. Optimum parameters of the geometric arrangement of the lidar are selected by numerical calculations. A method is proposed for determining the profile of optical thickness τ along the probing route in turbid atmosphere up to a value of $\tau = 8$. The method is verified in numerical and field experiments. The proposed method can be used for determining the slant range of visibility at airports. In this application, it must be taken into consideration that measurements can be made only during twilight and nighttime because of the influence of background light when working in the visible region of the spectrum. These restriction can be lifted by working in the ultraviolet range, for example by using an XeCl excimer laser with $\lambda = 308.2$ nm, where background light is reduced by 4-5 orders of magnitude compared with the visible range. Figures 4, formulas 6, references 9.



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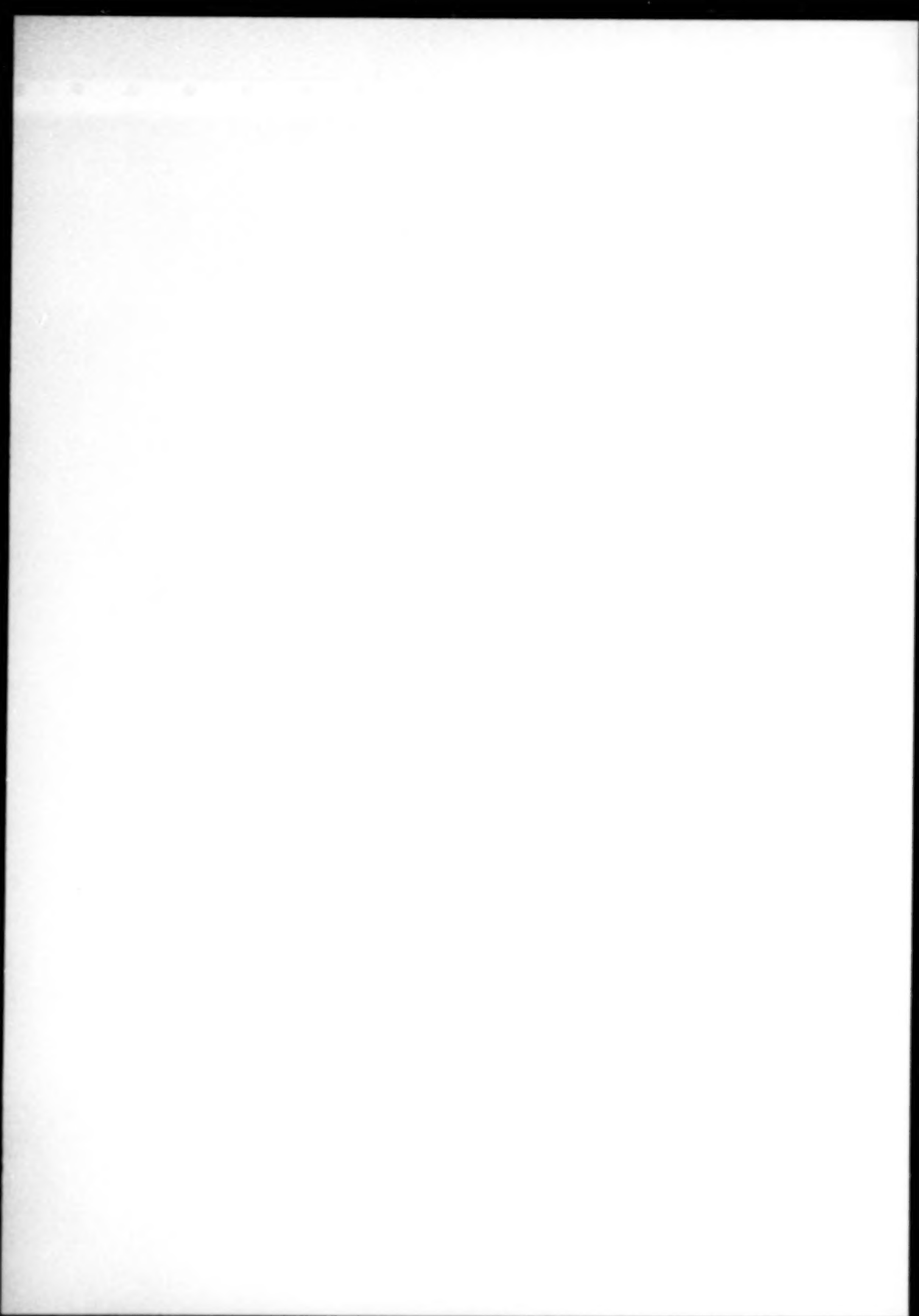
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